Carbon Sequestration and biodiversity conservation in Uttaranchal hills by holistic initiatives in village agro-ecosystem

Prepared for Ministry of Environment and Forests
Government of India

Submitted through Project Management Cell
TERI, New Delhi

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PROJECT BRIEF

1. IDENTIFIERS	
PROJECT NUMBER:	
PROJECT TITLE:	India: Carbon sequestration and biodiversity conservation in Uttaranchal hills by holistic initiatives in village agro-ecosystem
DURATION:	Seven years
IMPLMENTING AGENCY:	United Nations Development Programme (UNDP)
EXECUTIVE AGENCY:	Uttaranchal Forest Department
REQUESTING COUNTRY:	India
ELEGIBILITY:	India ratified the convention on Climate Change on 11/01/1993 and the convention on Biological Diversity on 11/02/1994
GEF FOCAL AREA:	Multiple focal areas of Biodiversity and Climate change
GEF OPERATIONAL PROGRAMME:	OP # 12: Integrated Ecosystem Management

2. SUMMARY: The project will promote the participatory Integrated Village Agro-Ecosystem (IVAE) approach as a means to achieve the protection of globally significant biodiversity, sequestration of carbon (C) and avoidance of soil and plant degradation in the ecologically fragile and globally important north-western Himalayan ecosystem of Uttaranchal State in India. The alternative GEF scenarios will build on the baseline by testing and applying the IVAE model at each of the 56 sites, promoting integrated catchment planning and removing the legal, policy and technical barriers to the IVAE. Village private lands and Civil & Soyam forests (C&S) will be targeted for holistic management. In the village private lands, production systems will be intensified by planting of fodder, fuel, fruit trees, medicinal plants and introduction of apiculture, pisiculture, sericulture and improved cattle breeds. This will be supplemented by the rationalization of land use and promotion of food and energy self-sufficiency. In the C&S forests, preparation of participatory microplans for management and sustainable development will be promoted by introducing indigenous tree species, medicinal and NWFP (non wood forest products) species, fodder plants and bamboo. Capacity building and empowerment of local institutions for income diversification through sustainable harvesting, value addition and viable marketing will be demonstrated. A model for equitable sharing will be tested for benefits/incentives accruing from IVAE. Moreover, the project will build institutional and technical capacity, will demonstrate technological initiatives for conservation and develop financial collateral for sustainable livelihoods by realization of environmental benefits for locals.

The project will be executed in phases. The initial phase (Y1–Y1.5) will focus on analysis of policy legal environment, removal of recognized barriers and promotion of an enabling environment for IVAE. The second phase (Y1.5–Y5) will primarily of testing models synthesized by combining indigenous knowledge with appropriate scientific methods at selected demonstration sites and cataloguing the lessons learnt. In the final phase (Y5–Y7), the results will be replicated by the community, as well as by the government departments and NGOs through ongoing projects. This will generate global benefits as well

as sustainable socio-economic and environmental benefits at the national level in economically and ecologically congruous areas well beyond the duration of the projects.

2. COST & FINANCE (MILLION US $)

Total cost of the project is US $ 6.44 million

3. ASSOCIATED FINANCING

4. ENDORSEMENT OF OPERATIONAL FOCAL POINT

5. CONTACTS

Principal Chief Conservator of Forests
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N.K. JOSHI,IFS
P.C.C.F.
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Office of the Uttaranchal State
85, Rajpur Road, Dehra Dun.

Dated, the August 8, 2001

Dear Shri Rawat,

I understand that F.R.I. and TERI are developing a project titled "Carbon sequestration and biodiversity conservation in Uttaranchal hills by holistic initiatives in village agro-ecosystems" for JEF funding. I have gone through the contents of the project. The Uttaranchal Forest Department endorses this project and would ensure basic support for implementation of the project in the state of Uttaranchal.

With regards,

Yours sincerely,

(N.K. JOSHI)

Enclo: As above.

Shri R.B.S. Rawat, IFS
Focal Person
JEF Cell
Ministry of Environment & Forests,
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LIST OF ACRONAMES & ABBREVIATIONS

BPL	: Below Poverty Line
C&S	: Civil and Soyam
FADA	: Forest Area Development Authority
FDC	: Forest Development Authority.
FSI	: Forest Survey of India
GEF	: Global Environment Facility
GHG	: Green House Gases
GIS	: Geographical Information System
GoI	: Government of India
GOUP	: Government of Uttar Pradesh
HDR	: Human Development Report
IVAE	: Integrated Village Agro-Ecosystem
JFM	: Joint Forest Management
LFA	: Logical Framework Analysis/Approach
MoEF	: Ministry of Environment & Forests
NGO	: Non Government Organization
NWFP	: Non wood forest products
OP	: Operation Programme
UFD	: Uttaranchal Forest Department
UNDP	: United Nations Development Programme
VLC	: Village Level Committee
VP	: Van Panchayat
WFP	: World Food Programme

PROJECT CONTEXT

Environmental context and global significance

1. The Himalayan range represents a unique amalgamation of geology, geomorphology, soils and drainage systems. The environmental importance of this area lies not only in its significant bio-diversity but also in its inseparable relationship with the long range ecological security and perpetuity of the Indian subcontinent's glacial and riverine systems. Degradation and deforestation in the Himalayas will destroy this abode of rich bio-diversity and also trigger off negative consequences for the productivity of the northern alluvial plains and deltaic regions in the east where river waters merge with international waters in the Bay of Bengal.

2. Uttaranchal, the recently created western Himalayan hill state[1] of India (Annex G1), lies between 28° 44' and 31° 28' N and 77° 35' and 81° 01' E. On the northern and eastern sides the state has a common international boundary Tibet (China) and Nepal, respectively, while its north-western boundary is shared with Himachal Pradesh. The state has a range of ecosystems, which provide environmental, social, cultural and economic support to society at the local, national and global levels. With the altitude varying from 300 to 3,500 metres there are diverse vegetation types ranging from tropical deciduous to alpine, grasslands, high altitude glaciers and a vast stretch of rivers, rivulets and wetlands.

3. The state of Uttaranchal has three physiographic regions, the Himalayas, the Shivaliks and the plains. Eleven out of 13 districts of the state represent the hill region belong to the biogeographical province 2B. The West Himalayas. The state is divided into four agro-climatic zones, subtropical (upto1000 m), warm temperate (1000-1800 m), cool (1800-2400 m) and cold (2400-3000 m). The annual rainfall of the state varies from 1000 to 1600 mm ad the temperature ranges from below freezing point in certain areas to 30-40° C in the plains and in some valleys (G.B. Pant Uni. of Agriculture & Technology 2001). Most mountain peaks are covered with snow during the winter while the higher peaks in the cold zone are perpetually snow-covered. The plains of the state are endowed with rich and fertile soils while the hills represent the youngest and ecologically fragile Himalayan mountain range. The undulating and rugged topography of the area with steep slopes has led to the adoption of the watershed as the basic unit for development intervention.

4. Two major '*hotspots*' of significance to biodiversity viz. the Kumaon-Garhwal Himalaya and the Shivaliks lie in the state. The region has six national parks, six wildlife sanctuaries, one biosphere reserve, one UNESCO World Heritage Site and two elephant ranges. Thirty-five different sub-types of six major forest types are represented in the region. The region has four priority centres for characterization of '*microhabitats*' with species and genetic diversity, Kedarnath, Nandadevi, the Shivaliks and Terai forests cover 64.81% percent of the geographical area of the state and are under various administrative controls. Around 70% (23,988 sqkm) of forests are classified as Reserve, Protected and Unclassed, while vested forests are under the ownership of the state's Forest Department. About 18% of forests (C&S forests) are under the control of the Revenue Department, 11.67% under Forest Panchayats[2];

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[1] Uttaranchal, the 27th State of Republic of India came into existence on 9th December 2000 by carving out the hill regions from the state of Uttar Pradesh.

[2] 'Forest Panchayat' means a committee constituted for the management of a Panchayati Forests, under the Uttaranchal Panchayati Forest Rules, 2001 and includes the Forest Panchayats existing on date of the commencement of these rules, under any rules. Panchayati Forest include any area (outside the municipal or

and the rest belong to private parties, municipalities and others (Forest Department, Uttaranchal Pradesh 2000).

5. The forest cover in the state, however, is only 23,260 sq km, which constitutes 43.49% of its geographical area. There has been a net increase of 17 sq km in the forest over in 1999 as compared to the 1997 assessment. The change matrix reveals that there has been an overall decrease of 51 sq km of dense forests. This is the result of degradation of 57 sq km of dense forest to open forest and one sq km to non-forest that is partly offset by conversion of seven sq km of open forests to dense forest. (FSI, Supplementary 1999).

6. The region is richly endowed with flora and fauna. The forests are unique with spectacular plant groups such as conifers, rhododendrons, *Quercus* (Oak), *Acer* (maple), *Berberis, Primula, Saxifraga, Saussurea*, orchids, *Hypericum, Impatiens* etc. The region has a mixture of Indo-Malayan, European, Sino-Japanese, Mediterranean and African elements. It is a secondary centre for a number of important plants, notable among which are species of mountain bamboo, conifers, *Dalbergia, Acacia, Albizia*, oaks, *Rhododendron*, *Shorea* (sal) etc. Some of the regions are rich in floral diversity, for example, the Kedarnath Forest Division has 555 species of plants distributed over 32 sq km of the area in the temperate zone. Among the rare and vulnerable plants, over 400 species distributed among 250 genera representing nearly 90 families are known to occur in different localities of significance in Uttaranchal. It is estimated that 350 species of subsidiary food/vegetable, 50 fibre and cordage, 100 fodder-yielding, 20 biopesticidal species, 200 species of well-known aromatic and medicinal flora, bamboos and grasses, wild and cultivated ornamental species of horticultural value such as orchids, barberries, wild roses, primulas, zingibers etc. occur in the environs of the project area.

7. An estimated 29 species of plants yielding medicinal and aromatic NWFP have been found to be under threat of existence. These are grouped in IUCN categories, one species as critically endangered; 11 as endangered; 12 as vulnerable and five having a low risk at present. Many others may join this group in the next 10 to 15 years if no precautionary measures are adopted.

8. The state is the abode of diverse species of birds, mammals and reptiles including some threatened species such as the snow leopard, gharial and high altitude pheasants. Uttaranchal has the maximum number of mammalian species in the country - more than 75 but 6% of these are endangered species, while 13% fall under the vulnerable species category. The data deficient category constitutes around 9.75% of species. Amongst the threatened birds of the state, three species including pheasants are critically endangered, while two species are endangered and 11 are vulnerable. Additionally, seven species have restricted ranges of which one species, Himalayan Quail (*Ophrysea superciliosa*), once found in parts of Uttaranchal (the environs of Mussoorie and Nainital) was last seen in 1876; the species is now 'presumed extinct'.

9. The reptilian diversity in undivided U P includes crocodiles, turtles, tortoises, snakes and lizards. There are about 55 species of reptiles that were assessed in the CAMPS workshop held in September 1997. The only endangered reptile in the state is the Gangetic Gharial (*Gavialis gangeticus*). About 21 percent of reptiles are vulnerable while 11 percent are under

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cantonment limits) which has been duly constituted as such under these rules and shall have the same meaning as has been assigned to the Phrase "Village Forest" in the sub-section (1) of section 28 of the Act

the lower risk and least-concern category of the IUCN. Furthermore, the rivers and rivulets of Uttaranchal have considerable piscean diversity. There are 83 species, out of which 30 fall under different categories of threat.

10. Two types of grasslands are found in Uttaranchal, in the high altitudes and in the plains. The grasslands or the *chaurs* found in the Corbett National Park can grow up to two metres high making it ideal as ambush cover for predators while providing forage and fawning cover for herbivores. The major species of grasses occurring in the area include *Arundo donax*, *Phragmites karka*, *Apluda mutica* (Bassi), *Themeda arundinacea* (Ulla), *Cymbopogon* sp. (Jarakush), *Bothriochloa bladhii* (Sindhur), *Imperata cylindrica*, *Sachharum narenga*, *Sclerostachya fusca*, *Oryza rufipogon* (Tinna). Alpine grasslands or 'Bugyals' occur at altitudes above 3000 metres.

11. The Himalayan glaciers located in Uttaranchal are natural reservoirs and the source of dozens of perennial rivers along with innumerable rivulets, waterfalls and lakes. The two main rivers of the country, the Ganga and Yamuna, with their numerous tributaries originate from here and traverse the Indo-Gangetic plains before merging into the Bay of Bengal. However, unsustainable development and ecosystem degradation has led to the retreat of glaciers in many places. The glaciers of Garhwal are reportedly retreating at a rate of 12 to 14 metres per year (Pal D *et al* 2001).

Socio-economic context and anthropogenic pressure

12. The primary economic activity in the state is agriculture with an estimated 58 percent of the main workers[3] dependent on cultivation including about 5% agricultural labourers. Agriculture in Uttaranchal is fraught with constraints. The availability of a small net sown area[4] coupled with an increasing population has reduced the family holding into tiny, fragmented and scattered farmlands. Over 70 percent of holdings are marginal with an average of only 0.8 ha per household in the hill districts. These fields are terraced situated on the southern aspects of hills and are deprived of any irrigation facilities. The soils range from sandy to sandy loam. As a result, percolation losses of water from terraced fields are high. Agriculture and food production is, therefore, subject to the seasonal vagaries of rainfall and cannot satisfy the subsistence requirements of the people. In this context, animal husbandry is an inseparable part of an agriculture-based economy.

13. Most families in the hills depend on livestock for manure, draught power, milk and meat. In the absence of surplus income from agriculture, people depend on the sale of goats and sheep to meet sudden financial needs. The domesticated animal diversity of the state is composed of cattle (2.08 million), buffaloes (1.06 million), cows (.12 million), sheep (0.3 million), goat (1.09 million) and poultry (.08 million). However, in the hills more than 90 percent of cattle and buffaloes are non-descript. Villages in far-flung areas of the hilly regions are still unaware of new developments in crossbreeding, improved feeding and animal health practices. Low milk yields and low draught capacity compel people to keep larger herds of animals, which characterises the livestock system in the hills.

[3] According to the Census 2001, out of the total workers in the State 88percent are main workers and 12percent are marginal workers.
[4] The net sown area is found as low as 4.97percent in Chamoli to a maximum of 17.5 percent in Bageshwar.

14. The large number of animals has increased the demand for fodder and also the pressure on forests and biodiversity of the area. There has been no systematic/planned effort towards producing fodder through agro-forestry. On the other hand, the C&S forests and most of the forests under the Van Panchayat are in a degraded state, with only about 10 percent and 40 percent of their potential tree wealth (GOUP Undated). This has resulted in increased pressure on Reserve Forests by unregulated grazing, lopping of trees etc. Grazing pressure on an average amount 5 to 5.67 cattle units per ha, which is 2.83 times higher than the carrying capacity of the forestlands. Increasing conversion of oak forests to pine forests has also added to this problem, since pine does not provide either fodder or as much fuel wood as oak does. Also since pine needles suppress the growth of grass on the forest floor, the locals sometimes use artificial fires to assist grass growth. This may lead to forest fires and a substantial loss of forest cover.

15. The other major threat to biodiversity is the unsustainable harvesting of NWFP (non wood forest products). A serious consequence of the low productivity of agriculture and livestock is the overexploitation of NWFP including medicinal plants to supplement income. Extraction of medicinal plants in alpine meadows for consumption and sale has resulted in over-exploitation of several herbs. Pressures are particularly high on *Orchis latifolia, Picrorhiza kurrooa, Jurinea macrocephala*, and *Aconitum heterophyllum*. The returns to the community, however, are scanty. Lack of processing at source, a deficient marketing and crediting infrastructure and lack of strong enterprises allow only a small percentage of the actual value of the product to reach the people. They function more as gatherers than actual entrepreneurs, the profits being usurped by the middlemen and traders.

16. Increasing population with deficient agricultural production, large and unproductive bovine population, scanty returns from NWFP, and degraded community forests form the vicious cycle of poverty and put tremendous pressure on forests in the region. As per the recent BPL (below poverty line) census, 36.44 percent of rural families in Uttaranchal fall in the BPL category, of these 12 percent are headed by women (Sinha & Naithani Undated). Poverty, on the other hand, also acts as a push factor for widespread migration, which compels women to shoulder much of the work in agricultural fields[5] and in meet demands for fuelwood and fodder to maintain livestock.

Legal and Institutional context

17. India ratified the convention on Climate Change and the Convention on Biological Diversity in 11/01/1993 and 11/02/1994, respectively. At the national level, the Wildlife Act passed in 1972 and amended in 1991 is the unified national act for biodiversity conservation. However, an amendment to the Wildlife Act is considered necessary at present, as it does not talk about eco-development, which is being made an integral part of conservation. In 1976, forests were added to the concurrent list of the Constitution, giving the Centre and the State shared responsibility and control over forest matters. The GOI has the power to legislate on forestry issues, but only after consulting the state. The responsibility of administering the forests lies primarily with the state governments. The other significant legislation for forests and biodiversity conservation was the 42nd Amendment to the Indian Constitution, which

[5] Contribution of women to agriculture is more than 80 percent in Uttaranchal.

made the protection and improvement of the environment and safeguarding of forests and wildlife a Directive Principle of State Policy.

18. The ownership of forests in Uttaranchal lies with the state forest department (69.2 percent of the total forests), revenue department (29.9 percent of total forests) and the rest belongs to private, municipalities and others. Around 11.67 percent of the revenue forests are under the management of Forest Panchayats.

19. Forest Panchayats popularly known as Van Panchayats (VP) were created in 1931 in Uttaranchal to enable the people to manage a portion of revenue forests lying in the vicinity of their villages. Later, in 1976 the Uttar Pradesh (UP) government made amendment to the VP Act to bring VPs within the ambit of the Indian Forest Act and framed a set of rules to govern them. The Uttaranchal Forest Rules, 2001 made a further amendment to the VP Act that has given greater control to the FD in the management of these forests. There are nearly 7,000 VPs today.

20. The C & S division of the state FD is responsible for providing technical and managerial inputs while ownership is with the revenue department. The interventions hitherto undertaken in these forests showed a complete lack of co-ordination between the FD and revenue department. Hence, afforestation was done on a piecemeal basis without a proper working plan. There was no conscious and unified effort to reconcile the local subsistence demands from these lands thereby reducing additional pressure on biodiversity, biomass and carbon stock in the region.

21. The National Forest Policy 1988, for the first time in India, set its primary objective as creating a massive people's movement with the involvement of women for the regeneration and protection of forests under the ı Ɔ. Later in 1990, the passing the Guidelines for Joint Forest Management (JFM) by the MOEF formalized system of joint partnership between the ecosystem community and forest department to manage and protect the forests. Uttaranchal came under the JFM programme in 1997 when the UP Government passed the Guidelines for involving forest fringe communities in the regeneration and protection of degraded forests (Reserved and Protected). Following the guidelines of the MOEF, the UFD created the FADA (Forest Area Development Agency) in 2001 to coordinate the activities of village development in JFM villages. In 2001, more than 600 000 ha of forests in Uttaranchal were under JFM. These are mostly Protected and Reserve forests.

22. The Forest Acts and Rules also have a bearing on the utilization of private lands. The Rural Tree Protection Act 1976 imposes restrictions on landholders from felling trees (of specific species) from their lands while the Transit Rule 1978 bans transporting timber and other forest products including medicinal herbs without a prior permit from the Divisional Forest Officer (DFO) on payment of a certain fee. Moreover, the procedures for obtaining clearance are cumbersome, complex, and act as disincentives.

23. There is also a need to encourage homestead forestry and private agro-forests through institutional provision of adequate information, marketing support and extension measures. The Forest Corporation, the organization responsible for marketing of forest products, has not been giving adequate support to marketing agro-forestry products like timber or medicinal plants.

24. Agro-forestry is an important mechanism of meeting society's many forest-based needs from private lands, thereby indirectly protecting biodiversity and biomass from subsistence pressures. Encouraging agro-forestry initiatives through conducive legal and institutional support is, therefore, crucial for reducing land degradation, providing adequate livelihood support, meeting the biomass need and improving the carbon balance in the Himalayas.

Emerging issues and proposed strategies to overcome them

25. The carbon flow estimates for India range from 'no net emissions' to 4.1 million tonnes (ADB 1998). At present the carbon emissions from the forest and land use change are nearly offset by carbon uptake in forests, regenerating forests and plantations. Projections indicate that the carbon emission is likely to increase to 77.3 MT of CO_2 by 2020 (ADB, 1998). This calls for further mitigation measures.

26. In Uttaranchal, the major threat to the loss of Himalayan biodiversity and declining biomass stock is the degradation and unsustainable management of village agro-ecosystem in the region, which comprises:

- Private lands with an unfavourable land-use policy and inadequate returns
- Degraded community forests in the absence of sustainable management and due to low input/low output livestock
- Degraded Reserve and Protected forests due to unsustainable harvesting and management of NWFP and other subsistence needs

27. Given the large growing human and livestock pressures and rural poverty, the forests are likely to come under increased pressure for meeting biomass demands. Thus, existing forests will be subjected to increased rates of unsustainable extraction leading to degradation and GHG emissions. The mitigation options that could be pursued in the region are enhanced natural regeneration of forests and protection of C & S lands and development of agro-forestry in private lands.

Private lands and agro-forestry

Issues

28. Agroforestry has been promoted across the country, as a means to divert pressure from the forests by meeting biomass needs, providing additional income and also as a means to check soil erosion. However, in Uttarancahal there has not been a concerted effort to develop an integrated technological packages addressing the specific natural resource constraints, soil and moisture conservation measures and meeting the demands of the population. This has led to underutilization of lands, soil erosion and a resultant loss of soil carbon. Uttaranchal has a large number of absentee landholders but the prevailing land tenure policy does not permit a subletting arrangement and sharecropping, thus leaving large tracts of agricultural land either unused or poorly management. Furthermore, an institutional set-up, tools and trained manpower for disseminating the technical and other information to potential adopters of agro-forestry is also absent.

Strategies to overcome the issues

29. To address the above issues interventions will be made in three broad areas. To begin with legal, policy and tenurial issues will be addressed to promote a favourable milieu for the development of agro-forestry. Demonstration of agro-forestry model in the second phase will include soil and water conservation measures and plantation of grasses, timber and horticulture species, medicinal plants and bamboo. The grasses planted along the bunds of the fields will play an important role in soil and moisture conservation in addition to fodder source. Capacity building and technical training of the agro forestry adopters and selected local educated unemployed youths/ NGOs will be an integral part of the intervention. In the final phase, adequate attention will be paid developing and field testing the innovative extension strategies and tools for dissemination and replication in other areas (Detail in Annexure I).

Medicinal plants

Issues

30. In the absence of an adequate income from agriculture and livestock, medicinal plants from forest areas supplement income. On the other hand, an unorganized and exploitative marketing network results in inequitable distributions and more pressure on forests. But there has been very little effort to in disseminate packages based on the cultivation of medicinal plants along with tree crops in individual and community lands. This is primarily due to the lack of a multidisciplinary approach and coordination among various government departments. Lack of adequate staff is a major constraint in the successful implementation of these measures. Also, there is lack of adequate policy and institutional support in promoting a sustainable model of natural resource use.

Strategies to overcome the problem

31. Legal and policy issues related to medicinal plant cultivation, harvesting and marketing will be studied and modifications will be suggested and advocated. Economically profitable medicinal plants will be promoted for agro-forestry as also on civil and soyam forests. Women will be especially targeted for imparting technical training and capacity-building on aspects such as medicinal plant harvesting, grading and processing. In the final phase, adequate attention will be paid to developing and field testing the innovative extension strategies and tools for dissemination and replication in other areas (Detail in Annexure I).

Livestock development

Issues

32. Livestock in Uttaranchal is a very important component of the rural economy as more than 80 percent of the people live in rural areas and depend on agriculture, animal husbandry and use of forest land for livelihood. However the scope for effectively utilising the vast livestock wealth in the state is constrained by low genetic potential, inadequate nutrition, poor health facility and inefficient livestock management practices.

Strategies to overcome the problem

33. Proposed strategies to overcome these constraints include control of the livestock population, a breed improvement programme, intervention for fodder development, training of local educated, unemployed youth for providing healthcare facilities at the village level and setting up of demonstration farms for poultry, angora rabbit-rearing for income generation (detail in Annexure I).

Civil and Soyam forests

Issues

34. Civil and soyam forests as discussed earlier are completely degraded due to improper management. These lands were targeted till today for wood production rather than meeting the diverse needs of the society. The institutional set up is insufficient to promote the sustainable use of such common lands. The JFM promoted by the FD has a limited focus on the development of degraded forestlands. Non-forestland categories of village ecosystems are not included in these approaches and neither is there an integrated approach for the development of these lands to increase biodiversity and biomass stocks.

Strategies to overcome the problems

35. Participatory multilocation_demonstration trails to re-vegetate degraded C&S forests and other community land through silvi-pastoral interventions, replacement of exotic species, reintroduction of native/indigenous broad leaf multi-purpose trees, NWFP species and bamboos in terraced fields would be undertaken. The reintroduction of silvicultural practices and social fencing prevalent in the pre-colonial area would enhance the production of grasses, fodder leaves and fuel biomass leading to a reduction of biotic pressures on natural forests (detail in Annexure I).

Project objectives and rationale

36. The objective of the GEF alternative is to demonstrate integrated village agro-ecosystem development in four selected areas of Uttaranchal and disseminate the concept across the Himalayan region in an effort to conserve the Himalayan biodiversity and enhance carbon sequestration.

37. Global objectives: The project aims to enhance carbon sequestration by assimilating carbon in standing biomass and soil through revegetation of village lands (private, civil and soyam) and reducing the pressure on reserve and protected forests. The project also aims to conserve biodiversity through regeneration and plantation activities in private and common lands. The project will also reduce land degradation in all types of lands.

38. National objectives: Promoting the practice of growing trees outside traditional forest areas to reduce the pressure on forests and rehabilitating degraded forest areas are both priority areas under the National Forestry Action Plan, 1999, common to the objectives of the present projects.

39. Regeneration and protection of forests in Uttaranchal will also protect the national rivers and waters by protecting the glaciers and catchment. Protection of water sources, reduction in land degradation and soil erosion will assure food security by protecting the Indo-Gangetic valley. The project aims to disseminate the integrated agro-ecosystem concept to regenerate and protect the forests of other hill states of India through the design of innovative extension tools and strategies.

40. Local objectives: The project aims to improve the local environment by reducing land degradation, minimizing pressure on the reserve forests and facilitating sustainable livelihoods to the rural community by promoting the integrated village agro-ecosystem approach. Interventions in participatory village agro-ecosystem development will include better utilization of private lands through agro-forestry intervention, improvement of livestock and introduction of livestock production techniques, protection and management of all potential civil and soyam forests for meeting local subsistence demands. Revegetation of village lands (private and civil and soyam) will include plantation of grasses, timber species, medicinal plants, bamboo and horticultural species. The development of market linkages will also generate additional employment and income opportunities for local women and educated unemployed youths. Institutional development and capacity-building of the local people and NGOs can help make information on technical aspects (microplanning, agro-forestry, animal health etc) easily available.

Project Activities/components and expected results

41. The logical framework developed for the project including its outputs, an indicative list of activities, verifiable indicators, means of verification and assumptions is presented as Annexure B. However, a brief description of the immediate objectives and outputs is presented below.

Immediate Objective 1: **To identify policy and legal barriers in adoption of integrated IVAE approach and advocate appropriate measures**

Current policy and legal measures are not conducive to the rehabilitation of common access land resources and promotion of agroforestry in private lands. The project will identify the policy and legal barriers and recommend remedial measures. Advocacy and opinion building on the remedial measure will be undertaken to influence policy makers. The expected outputs and the planned activities are given below:

Output 1.1 **Policy and legal obstacles in adoption of integrated IVAE approach identified**

1.1.1 Identify policy and legal constraints in the way of community-based management and utilization resources from C&S forests and suggest remedial measures
1.1.2 Identify policy and legal constraints to agro-forestry development and suggest remedial measures
1.1.3 Identify policy and legal constraints to sustainable utilization of wood and non-wood products from private lands and recommend remedial measures
1.1.4 Identify lacunae in the current land tenure systems and recommend amendments amenable to rehabilitation of deserted private lands (fallow) and suggest remedial measures

Output 1.2 **Identified policy and legal measures advocated**

1.2.1 Advocacy/opinion-building of recommended policy and legal measures for rehabilitation of C&S lands
1.2.2 Advocacy/opinion-building of recommended policy and legal measures for promotion of agroforestry in private lands.

Immediate objective 2: **To establish appropriate institutional mechanisms to operationalize the integrated IVAE approach**

The project will build upon strengthened capabilities of existing institutions along with link to ongoing programmes. Precautions will be taken to ensure the institutional mechanism will not operate at cross-purposes with the mechanism under other ongoing programmes, but will complement the current mechanism.

Output 2.1: **Appropriate institutional mechanisms established with special emphasis on gender balance**

Local institutional mechanisms will be established with representation by women for the participatory management of common resources. Efforts will also be made to link government departments and relevant private agencies to provide better services to the village community. The following activities will be undertaken to achieve this output.

2.1.1 Build-up from existing experience of JFM/Village Panchayat and indigenous management systems for institutional management of C&S
2.1.2 Establish participatory institutions for management of C&S lands
2.1.3 Identify reputed local NGOs
2.1.4 Link up with existing infrastructure of animal husbandry and local governance departments to provide veterinary services through trained para-veterinarian and NGOs
2.1.5 Link up with private sector to provide information and training to farmers for poultry and angora rabbit-rearing.

Output 2.2: **Capacity of all stakeholders built in institutional, managerial and technical aspects of sustainable management of resources**

The capacity-building of stakeholders is critical to the success of the IVAE approach. All stakeholders will be trained in the institutional, managerial and technical aspects of the sustainable management of resources. Special efforts will be made to build the capacity of women, ensuring their participation in the decision-making process. To enable adaptive management at a local level, village communities will also be trained in monitoring and evaluation. Activities towards achieving the output are:

2.2.1 Training in microplanning and integrated IVAE approach
2.2.2 Training village community in microplanning, institutional governance and technical aspects of rehabilitation of C&S lands
2.2.3 Training village community/village institutions in participatory monitoring and evaluation (including enumeration of biological resources)
2.2.4 Training identified farmers on all aspects of agoforestry (including exposure visits)
2.2.5 Training identified village-based youth as para-veterinarians
2.2.6 Training identified beneficiaries for livestock production programmes
2.2.7 Training people to weave of angora wool and developing products.

2.2.8 Training relevant stakeholders including state government departments in integrated IVAE approach and in GIS-based planning and monitoring of project activities
2.2.9 Training identified NGOs in sourcing information on various developmental activities and networking

Immediate objective 3: **To demonstrate models for sustainable management of private as well as common access land resources and improvement of livelihood status of rural community**

Integrated models for the sustainable management of common lands (C&S land) and private land will be demonstrated. The activities will rehabilitate land resources and improve the biomass supply to the local community. Improvement of the livelihood status of the rural community is an integral component of all the interventions.

Output 3.1: **Sustainable land use models including soil and moisture conservation measures on civil & soyam lands demonstrated**

Various technologies for rehabilitating civil and soyam forests will be demonstrated. The key to this intervention is the preparation of a microplan in a participatory way. The microplan will address intervention in other sectors, but the focus will be on rehabilitating C & S forests. A basket of technologies including those on silivipasture, mediculture, etc. will be presented to the community to make an informed choice. Soil and moisture conservation activities will also be undertaken as part of the technology demonstration.

As mentioned earlier, the establishment of an institutional mechanism to plan and manage activities is crucial to any intervention on civil and soyam lands. As part of this institution arrangement social fencing would be introduced for protection of the treated areas and a mechanism for sharing usufructs would be evolved.

The activities that would lead to this output are:

3.1.1 Prioritize technical options for management of Civil & Soyam land from the menu of short-listed packages in consultation with identified institutions
3.1.2 Develop a micro-plan for the management of civil & soyam land
3.1.3 Demonstrate models (including soil and moisture-conservation activities) for rehabilitation of C&S lands

Output 3.2: **Sustainable land-use models including soil and moisture conservation measures on private agricultural lands demonstrated**

This will demonstrate and promote agroforestry as an alternative system land management for on private agricultural lands. The agroforestry models, in addition to diversifying the agricultural production system, will increase the farm income and enhance soil conservation. A basket of systems/technologies including those on silivipasture, agri-horticulture, mediculture etc. will be presented to the beneficiaries to enable them to make an informed choice. The activities that will be undertaken to achieve the outputs are:

3.2.1 Identify interested farmers for demonstration of agroforesty models
3.2.2 Prioritize agroforestry (including horticultural) models from the menu of short-listed packages in consultation with village community

3.2.3 Demonstrate agroforestry models

Output 3.3 **Improved livestock management techniques demonstrated**

Improved livestock breeds will be introduced to reduce the number of animals a family needs to maintain to meet its milk requirement. Alternative activities for income generation such as poultry and angora rabbit-rearing will be introduced to discourage people from rearing goat and sheep. The activities planned under this sector are

3.3.1 Identify beneficiaries for introducing improved bovine breeds
3.3.2 Implement livestock intervention models for bovines
3.3.3 Identify locations and beneficiaries for specific livestock production demonstration units
3.3.4 Implement livestock intervention models for production units

Output 3.4 **Innovative market development models identified and participatory marketing mechanisms evolved**

Intervention for market development will augment the local community's income by providing relevant marketing information to the producers and also by establishing link with potential markets for agroforestry products.

3.4.1 Study various in-place marketing models to develop a participatory marketing mechanism
3.4.2 Establish forward linkages with institutions for market information about the marketable produce and backward linkages for information dissemination at village level
3.4.3 Build capacity of local governance institutions in market information, institutional linkages and database maintenance
3.4.3 Identify and establish mechanisms for post-harvest operations such as grading, processing and local storage by enhanced involvement of women, and blending of traditional knowledge.

Output 3.5: **Self-help groups established for women's empowerment**

This component aims to empower women economically by establishing self-helps groups and other income-generation activities. It is based on the assumption that economically empowered women will have a greater say in the decision-making process.

Immediate Objective 4: **To conduct monitoring and evaluation for adaptive management**

Periodic monitoring and evaluation are the keys to adaptive management. It involves conducting participatory monitoring and evaluation of the project activities planned and implemented. An inventory of the biodiversity status will also be prepared which will be updated periodically. The data generated from the biodiversity monitoring can be converted into useful indices at the project implementation office. A database and a framework for estimating carbon sequestration will be developed at the level of the project implementation office. The outputs and activities towards meeting them are given below:

Output 4.1 **Functional participatory monitoring mechanism established**

4.1.1 Establish mechanism for participatory monitoring and evaluation of project activities.
4.1.2 Undertake participatory monitoring and evaluation (concurrent, mid-term and terminal) of planned and implemented project activities.

Output 4.2 **Biodiversity status monitored on a participatory basis**
4.2.1 Prepare inventory of fauna and flora.
4.2.2 Conduct periodic monitoring of biodiversity status.
4.2.3 Update inventory.

Output 4.3 **Database for estimating carbon sequestration developed**
4.3.1 Collect data from project sites.
4.3.2 Create database.

Output 4.4 **Adaptive management enabled/operational**
4.4.1 Analyze results of monitoring and evaluation.
4.4.2 Redirect project activities based on results of monitoring and evaluation.

Immediate objective 5: **To develop and operationalize extension strategy to facilitate dissemination and replication of IVAE approach**

The project aims to disseminate the information, knowledge and learning generated from the project to other areas of Uttaranchal for facilitating replication of the IVAE approach. An extension strategy including an enabling institutional mechanism will established for flow of information to all the stakeholders.

Output 5.1: **Packages for integrated IVAE prepared based on the demonstrations carried out**

Successful intervention models and project findings will be documented and finally packages on IVAE for the different altitude zones of Uttaranchal prepared. Global benefits from carbon sequestration and biodiversity conservation will be documented for the benefit of all stakeholders. Activities undertaken to achieve the desired output are:

5.1.1 Document successful models in all sectors of intervention leading to integrated management of IVAE.
5.1.2 Audio-visual documentation of successful models in all sectors of intervention.
5.1.3 Document project learning, outcomes and impacts based on the results of monitoring and evaluation.
5.14 Prepare packages for different altitude zones of Uttaranchal.
5.1.4 Document global benefits such as carbon sequestration and biodiversity conservation.

Output 5.2: **Extension strategy and enabling institutional mechanism for dissemination of information in place**

Strategies for two-way flows of information to the village community along with an enabling institutional mechanism will be established. Innovative tools for disseminating the information will be developed and field-tested in the project areas. The activities that will be undertaken are:

5.2.1 Analyze the current flow of information and institutional mechanism.
5.2.2 Design and establish strategies for continuous flow of information to the village community including an enabling institutional mechanism.
5.2.3 Design and field-test innovative tools for dissemination of information.

Output 5.3 **Extension packages disseminated**

In addition to the long-term strategy for information dissemination, short-term and immediate measures will also be undertaken to disseminate the concept. The measures include organizing workshops, meetings, awareness camps for the stakeholders, conducting exposure visits to the project sites. Information will also be disseminated using TV, radio, local newspapers etc. The project will also bring out newsletters containing technical information about models and marketing information of the produce. The activities that will be undertaken are:

5.3.1 Organization of workshops/seminars to disseminate project learning, outcomes and impacts.
5.3.2 Establishment of regular networks for dissemination.
5.3.3 Organization of exposure visits to project areas.
5.3.4 Dissemination of information through mass media.

Project sites

42. The project will be implemented in four selected clusters located in three micro-watersheds, Irgad in Pauri Garhwal district, Malyal Gad in Almora district and Lohawati in Champawat district; and one sub-watershed Kosi, in Almora district, covering 56 villages and a population of 10,000 (Annex G1). Being a demonstration project in hilly areas, easy access was an important factor in selecting the site. The sites in Almora will serve as a demonstration for the Kumaon region while the sites in Pauri Garhwal will facilitate replication in the Garhwal region. Since it is located on the Nepal border, Champawat will have the potential to advocate the concept on a international horizon. These areas will be the most suitable for integrated ecosystem management as the concentration of agricultural lands and availability of C & S forests is maximum in these areas (Annex G2).

Project phasing

43. The multi-faceted project activities will be implemented in three phases over seven years. The first one and a half years will be used for establishing the organizational structure, legal and policy studies, advocacy for building consensus for conducive policy and legal environment, capacity-building at all levels, participatory planning for IVAE management and technical inputs required prior to agro-ecosystem development activities such as soil and moisture conservation works. Demonstrations of the technical models on private, civil and soyam forests and livestock development will be taken up over the next 3.5 years. Capacity-building activities will be continued in this phase. However, maximum importance in this phase will be given to building tie-ups for marketing products so that maximum economic incentive/returns to the beneficiaries are ensured. The last two years will be devoted to refining the extension tools and strategies to ensure the sustainability of the model in the project sites and its wider replication in other areas.

Risks, sustainability and replicability

44. The project strives to put in place a strong institutional mechanism and a supportive policy structure to ensure the sustainability of the activities initiated. The individual sustainability aspects are given below:

Social and institutional sustainability

45. Strong participatory institutions developed during the project period shall ensure of that the project activities are sustained and their extension to areas beyond the duration of the project. The project will facilitate participation of various stakeholders, especially the local community beginning from planning, during implementation and monitoring along with capacity-building. The project will build upon strengthening capabilities of existing institutions along with establishing adequate linkages with the ongoing programmes. Gender sensitivity in the decision-making process and income-generation activities will sustain the interest of women and their participation in project activities. Local NGOs will also be part of the project planning, implementation and monitoring process. The enhanced technical capacity of different stakeholders in the project and development of inter-sectoral linkages will ensure dissemination of the project concept to other areas.

Technical sustainability

46. The preparation of a project brief has resulted in strong collaboration between premier technical institutes and relevant experts in all the sectors involved in interventions. This association during project implementation will ensure appropriate adaptable technical designs to facilitate biodiversity conservation and sustainable development.

Environmental sustainability

47. The proposed project intervention will improve the soil moisture regime and result in higher biomass yields leading in turn to the maximization of environmental benefits. This will provide a sustainable livelihood and ensure biodiversity conservation, arrest land degradation and enhance the sequestration of carbon in biomass and soils.

Financial sustainability

48. The project interventions represent a balanced mix of short-term and long-term income generation activities. This will ensure not only the continued interest of stakeholders in the project, but also contribute to the revolving fund envisaged in the institutional mechanisms to sustain activities in the post-project period. It will also be supported by collateral established during the project period between local village institutions and financial bodies such as banks, government agencies and department of small-scale industries in the state.

Replicability of the project

49. The project interventions the potential to be reproduced in ecologically and economically congruous areas of India and neighbouring countries such as Nepal and Bhutan. This will require motivation of stakeholders, technical capacity-building and development of financial linkages. The project has the following in-built features to achieve these objectives:

Models will demonstrate the potential of income-generation activities for sustainable livelihood.

Development of participatory extension strategies and tools, which will facilitate dissemination and replication.

Development of institutional mechanisms and linkages for dissemination of information.

Exposure visits during the project period to demonstration sites will motivate people to adopt interventions in new areas.

Collateral development with financial institutions will ensure financial support for replication of interventions in other areas of the state.

Risks and minimization measures

Risk	Risk rating	Risk minimization measures
The government does not respond positively to the recommendation on policy and legal environment or response is delayed.	Medium	Persuasion and opinion building through stakeholders
Inadequate participation by stakeholders (social fencing, training, adoption of interventions)	Low	Motivation and persuasion through local institutions
Poor inter-sectoral coordination for rehabilitation of C&S lands	Low	Inter departmental steering committee will ensure adequate coordination
Insufficient production of horticulture produce, honey, medicinal plants hindering developing viable marketing mechanism	Medium	Cooperative market approach based on collection from low yielding centres to ensure sustained supply for a viable market
Financial support from current government schemes for women's development is not received on time	Low	Persuasion and capacity-building through stakeholders support to influence government
People do not feel really empowered to carry out participatory monitoring and evaluation.	Medium	Strengthening endogenic decision-making process
Support not forthcoming from other government departments in disseminating information	Low	Inter-departmental steering committee will ensure adequate coordination

Linkages with ongoing programmes

50. The National Forest Policy (1998) and National Forestry Action Plan (1999) have identified biodiversity conservation, sustainable utilization of NWFP (including medicinal and aromatic plants) and an increase in the extent and productivity of forests through participatory approaches such as JFM as means of achieving the overall objective of alleviating poverty, employment generation and ecological security. The newly created state of Uttaranchal has 43% of its geographical area under forests, which makes the

implementation of policies and programmes to safeguard the interests of people and forests, imperative.

51. The interventions identified in the project brief under the GEF scenario complement the efforts of state government to achieve the objectives laid down in the recently-formed Forest and Agricultural Policy of state which include:

Forestry

- Restructuring of the Forest Department to deliver and suit the specific requirements of Uttaranchal
- Reorienting the forestry sector for people's participation and poverty alleviation.
- Introduction of bamboo cultivation through 160 Van Panchayats
- Conservation of medicinal plants and herbs
- Mulberry cultivation
- Women and farmers nursery
- Creation of medicinal plant board

Agriculture

- Providing basic facilities and strengthening agriculture pricing and marketing systems.
- Eco-friendly agriculture and stability in agricultural production.
- Conservation and consolidation of bio-diversity.

Animal Husbandry

- Preparation of bio compost
- Assistance to private animal breeders
- Collaboration with organizations of excellence
- Improvement of breeds of sheep and goat
- Improved breeding of Jersey and Holstein Fresian

Marketing strategies

- Reorganization of departments
- Constitution of two apex cooperative institutions
- Development of two tiered cooperative banking structure
- Milk procurement through cooperatives

Horticulture

- Horticultural development under special component plan
- Apiculture, off-season vegetable production, mushroom production and spice-production programmes.
- Development of floriculture and ornamental plants.

Local institutions

- Project formulations for poverty alleviation through SHGs etc.

52. The proposed project interventions dealing with legal and policy environment, capacity-building, extension, actual demonstration and development of marketing linkages will strengthen and complement the ongoing activities by providing required inter-sectoral linkages.

Stakeholders' participation and implementation arrangements

53. Utmost importance has been given to the stakeholders' participation in conceptualizing and designing the proposal during the six month-long PDF B process. This was achieved through a series of workshops at various places and also through focus group discussions and PRA exercises (Annexure E) at the proposed sites. The Uttaranchal Forest Department (UFD), the primary project implementing agency, has appointed one nodal officer of the rank of Conservator of Forests and also regional nodal officers in Kumaon and Garhwal regions (rank of DFO) for co-ordinating the PDF B process at the state and regional level. A project initiation workshop was organized at the state capital in Dehradun. During the workshops at Srinagar and Almora, conducted in Hindi, the project concept was shared with all the primary and secondary stakeholders of biodiversity conservation at the regional level. The workshop was also organized at the GB Pant University of Agriculture and Technology at Pantnagar. This university is engaged in research on agro-ecosystem development and biodiversity conservation. Stakeholders participating in these workshops included civil servants from development departments, scientists, sociologists, field experts from research institutes and universities, people's representatives and NGOs who will be active partners in implementing the projects. Village meetings and focus group discussions were held at 56 villages in four of the project sites in which whereby 1000 men and women belonging to different classes and castes were consulted to identify the current constraints and design strategies and actions essential for sustainable village agro-ecosystem management.

54. The Uttaranchal Forest Department will be the project execution agency and will coordinate with other departments on issues related to animal husbandry and fishery, horticulture, soil conservation etc. for technical and infrastructural facilities. The Chief Project Director will coordinate the project through the two Project Directors posted in the Garhwal and Kumaon regions and four Deputy Project Directors posted in four clusters. The Steering Committee will be responsible for overall monitoring and policy guidance. The Advisory Committees formed at the state and district levels will provide technical and scientific advice. The present institutional and infrastructure facilities including manpower will be used to implement the project.

Project financing

55. The total cost of the project including the baseline is US $ 6.44 million. Of the total sum, US $ 2.66 million is the baseline funding from Uttaranchal Forest Dept and the co-financing from GEF is US $ 3.77 million. Local communities will contribute 20 percent of the total cost for technical demonstration activities in cash and kind.

Project Output Budget (US $)

Sl No	Output	Total Cost($)	Baseline($)	GEF($)
1.1	Identification of policy and legal obstacles	80 438	0	80 438
1.2	Advocacy of identified policy and legal measures	26 088	0	26 088
2.1	Establishment of appropriate institutional mechanisms with emphasis on gender balance	88 046	0	88 046
2.2	Capacity building of stakeholders in institutional, managerial and technical aspects of sustainable management of resources	319 565	78 370	241 195

Sl No	Output	Total Cost($)	Baseline($)	GEF($)
3.1	Demonstration of sustainable land use models including soil and moisture conservation measures on Civil & Soyam lands	1 595 870	574 391	1 021 479
3.2	Demonstration of sustainable land use models including soil and moisture conservation measures on private agriculture lands	2 571 739	1 175 543	1 396 196
3.3	Demonstration of improved livestock management techniques	254 839	167 130	87 709
3.4	Identification of innovative market development models and establishment of participatory marketing mechanisms	152 174	0	152 174
3.5	Self help groups established for women's empowerment	95 434	23 858	71 576
4.1	Establishment of functional participatory monitoring mechanism	91 305	0	91 305
4.2	Participatory monitoring of Biodiversity status	17 392	0	17 392
4.3	Developing database for estimating carbon sequestration	26 087	0	26 087
5.1	Preparation of packages for promoting integrated IVAE approach based on the demonstrations carried out	195 656	39 130	156 526
5.2	Preparation of extension strategy for dissemination of information	86 959	4 347	82 612
5.3	Dissemination of extension packages	65 219	8 695	56 524
5.4	Replication of IVAE approach in other areas of Uttaranchal state	0	0	0
Project administration and management		782 609	586 956	195 653
Project total cost		**6 449 420**	**2 658 420**	**3 773 607**

Monitoring, evaluation & dissemination

56. The monitoring and evaluation will be undertaken in different phases and at different levels. Participatory monitoring and evaluation will be undertaken by the Village Level Committee (VLC) to enable adaptive management. Expenditure on all activities at the village level will be monitored through Social Auditing. The monitoring committee constituted at the block level will assist the VLC in monitoring and evaluation. The capacity of the VLC and the other stakeholders including the staff of the implementing agency (state forest department) will be enhanced for monitoring and evaluation. The VLC with assistance of the project staff will prepare an inventory of the biodiversity status and update it periodically. The data generated from the biodiversity monitoring will be converted into useful indices at the project implementation office.

57. Activities related to training and capacity-building will be evaluated using instruments such as questionnaires, group evaluation forms and open discussions.

58. Monitoring the success of the project will be undertaken formally (two mid-term and a terminal evaluation) based on the indicators listed in Log Frame Analysis (Annexure B). Preparation of a database for estimating carbon sequestration will be sub-contracted to leading national Forestry Research Institutes. The Steering Committee will meet at least one a

year and review the progress and make necessary recommendations. The Office of the Chief Project Director will be responsible for submitting the technical and financial reports.

59. The project aims to disseminate the information, knowledge and learning generated during the project to other areas of Uttaranchal for facilitating replication of the integrated IVAE approach. This will be achieved through developing strategies for a two-way flow of information to the village community along with an enabling institutional mechanism. Innovative tools for disseminating the information will be developed and tested in the project areas. Successful intervention models and project learnings will be documented and packages for integrated IVAE approach prepared. Global benefits from carbon sequestration and biodiversity conservation and the need for it would also be documented for the benefit of all stakeholders. Information will be disseminated through TV, radio, local newspapers and workshops. meetings, awareness camps for all the stakeholders, as also exposure visits to the project sites. The project will also bring out newsletters containing technical information about various models and marketing information for the produce.

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ANNEXURE A - INCREMENTAL COST

Broad Development Goal

The Tenth Five-Year Plan, adopted by the National Development Council, had accorded priority to agriculture and rural development with a view to generating adequate productive employment and eradication of poverty. It targets a growth rate of 8 per cent to double the per capita income by year 2012 and reduction in poverty by 15 percentage point. It also lays stress on ensuring environmental sustainability of the development process through social mobilisation and participation of people at all levels. The stress in rural development programme is on developing microfinance and increasing people's contribution towards development funds at gram sabha levels. The tenth five year plan has set a target of 25 % forest tree cover by 2007 and 33% by year 2012. JFM has been initiated to involve the people in protecting forest and this movement is being further strengthened.

Baseline

Increasing population with deficit agriculture production, large and unproductive bovine population, scanty returns from NWFP, degraded community forests form the vicious cycle of poverty has put tremendous demand pressure on forests in the region. As per the recent BPL (below poverty line) Census, 36.44% rural families in Uttaranchal fall in the category of BPL, of them 12% of the families are women headed (HDR). Poverty, on the other hand, also acts as a push factor for the wide spread migration, which compels the women folk to shoulder much of the works in agriculture fields1 and in meeting demands for fuelwood and fodder to maintain livestock.

The ownership of forests in Uttaranchal lies with the state forest department (69.2% of the total forests), revenue department (29.9%of total forests) and the rest belong to private, municipalities and others. Around 11.67% of the revenue forests are under the management of Forest Panchayats. Forest Panchayats popularly known as Van Panchayats (VP) were created in 1931 in Uttaranchal to enable the people to manage a portion of revenue forests lying in the vicinity of their villages. Later, in 1976 the erstwhile Uttar Pradesh government made amendment to the VP Act to bring VPs within the ambit of the Indian Forest Act and framed a set of rules to govern them. The Uttaranchal Forest Rules, 2001 made further amendment to the VP Act. There are nearly 7,000 VPs today.

The Civil and Soyam Division of the state forest department is responsible for providing technical and managerial inputs to VP managed lands while ownership is with the revenue department. The interventions hitherto undertaken in these forests showed complete lack of co-ordination between forest department and revenue department. Hence, afforestation was done on a piecemeal basis without having a proper working plan. There was no conscious and unified effort that sought to reconcile the local subsistence demands from these lands and thereby reducing additional pressure on biodiversity, biomass and carbon stock in the region.

The National Forest Policy 1988, for the first time in India, set its primary objective as creating massive people's movement with the involvement of women for regeneration and protection of forest under the forest department. Later in 1990 passing the Guidelines for Joint Forest Management (JFM) by MoEF formalized system of joint partnership between the ecosystem community and forest department to manage and protect the forests. Uttaranchal

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[1] Contribution of women in agriculture is more than 80% in Uttaranchal.

came under JFM programme in 1997 when the erstwhile UP Government passed the Guidelines for involving forest fringe community in the regeneration and protection of degraded forests (Reserved and Protected). Following the guidance of MoEF, UFD created FDC (Forest Development Corporation) in 2001 to coordinate the village development activities in JFM villages. In 2001, more than 6,00,000 ha of forests in Uttaranchal are under JFM, which are mostly Protected and Reserve forests.

The Forest Acts and Rules have its bearing on utilization of private lands. The Rural Tree Protection Act 1976 imposes restrictions on landholders from felling tree (of specific species) from their lands while the Transit Rules 1978 bans transporting timber and other forest produces including medicinal herbs without prior permit from Divisional Forest Officer on payment of certain fee. Moreover, the procedures for obtaining clearance are cumbersome, complex, and act as disincentives.

In Uttaranchal, the major threat to the Himalayan biodiversity loss and declining biomass stock is the degradation and unsustainable management of village agro-ecosystem in the region, which comprises of:

- Private lands with unfavourable land-use policy and inadequate returns
- Degraded community forests in absence of sustainable management and due to low input/low output livestock
- Degraded Reserve and Protected forests due to unsustainable harvesting and management of NWFP and other subsistence needs

Given the large growing human and livestock pressure and rural poverty, the forests are likely to come under increased pressure for meeting the biomass demands. Thus, the existing forests will be subjected to increased rates of unsustainable extraction leading to forest degradation and GHG emission. The mitigation options that could be pursued in the region are natural regeneration of forests through enhanced natural regeneration and improvement in management of Civil and Soyam lands and development of agro-forestry in private lands.

Agroforestry has been promoted across the country, as a means to divert pressure from the forests by meeting the biomass needs, providing additional income and also as a means to check soil erosion. However, in Uttarancahal there has not been a concerted effort to develop an integrated technological packages addressing the specific natural resource constraints, soil and moisture conservation measures and meeting the demands of the population. This led to underutilization of land, soil erosion and the resultant loss of soil carbon. Uttaranchal, though has large number of absentee landholders but the prevailing land tenure policy does not permit subletting arrangement and sharecropping and thus leaving a large agricultural lands either unused or under poor management. Furthermore, institutional set-up, tools and trained manpower for disseminating the technical and other information to the potential agro-forestry adopters is also absent.

Global Environment Objective

The sector based planning and the low of level of integration on all land use management has resulted in degradation of land resources from increased population pressure as well as failure/absence of institutions to undertake integrated management. This has resulted in two major impacts. One, the available biomass from the land has decreased over the years and also the capacity to growth biomass has declined. Two, the resultant degradation has resulted in loss of a number of flora and fauna Two major '*hotspots*' of biodiversity significance viz, Kumaon-Garhwal Himalaya and Siwaliks exist in the state. The region has four priority

centres for characterization of '*microhabitats*' with species and genetic diversity, e.g. Kedarnath, Nandadevi, Siwaliks and Terai. The region has six National Parks, six Wildlife sanctuaries, one Biosphere Reserve, one UNESCO World Heritage Site and two elephant ranges.

The present project objective is to decrease the degradation of various land uses through holistic approach to land management. The resultant impact would be in terms of increased biomass density on various land uses and decreased pressure on the forest resources of the State, which is a repository of important floral and faunal species.

GEF project Objectives

To address these above issues interventions will be made in three broad areas. To begin with legal, policy and tenurial issues to address the issue of promoting agroforestry on private lands and better management of Civil & Soyam lands. This is aimed at increasing the availability of biomass for fodder and fuelwood and thus relieving the pressures on Forest Lands. This strategy would supplement the identification of legal and policy barriers with demonstration of agro-forestry models and participatory multilocation demonstration trails to re-vegetate degraded *civil and soyam* forests and other community lands. Demonstration of agro-forestry model in the second phase will include soil and water conservation measures and plantation of grasses, timber and horticulture species, medicinal plants and bamboo. The grasses planted along the bunds of the fields will play an important role in soil and moisture conservation in addition to fodder source. Demonstration on C&S lands through silvipastoral interventions, replacement of exotic species, reintroduction of native/indigenous broad leaf multi-purpose tree, NWFP species and bamboos in terraced fields would be undertaken. The reintroduction of silvicultural practices and social fencing prevalent in pre colonial area would enhance production of grasses, fodder leaves and fuel biomass from such areas leading to alleviation of biotic pressures from natural forests

The other source of pressure on forest resources is due to fodder demand from large population of livestock with low productivity and NWFP (especially medicinal plants) extraction from forest areas to supplement incomes. The second strategy addresses this issue and has two prongs. One, control of livestock population through breed improvement programme. Two, increasing avenues of income generation through growth of medicinal plants on private and C&S lands as well as other livestock activities such as setting up of demonstration farms for poultry, angora rabbit rearing.

The third strategy addresses the important barriers, lack of adequate capacity at local level and weak information access channels. The capacity building would be undertaken in training of the agro forestry adopters, various aspects like medicinal plants harvesting, grading and processing, training of local educated, unemployed youths for providing healthcare facilities at the village level and capacity at local level on micro-planning as well as management skills for managing C&S and common land resources. Informational access for adopting better practices and alternatives on agriculture land, marketing information, access to financial resources to would be addressed through design of mechanisms that are self sustaining and responsive to the needs of locals for better management of their resources.

Global Environmental Benefits

(i) Carbon Stock
The carbon stock in vegetation under various sites varies greatly due to different vegetation types. On an average the carbon stored (106.7-t h^{-1}) by temperate forest of Nishani (119.7 t h^{-1}) and Forti. Similarly the Pine dominated sites stored on an average 171.0 t h^{-1} of Carbon except for Kunwali and Phagsa (66.5 t h^{-1}). The high carbon storage in these pine dominated sites is a reflection of old growth forest compared to Kunwali and Phagsa. The carbon stock (83.8 t h^{-1}) of Civil Soyam Forest of Nishani village indicates is low compared to the carbon storage recorded 213 t h^{-1} under such similar forest dominated by Oak and Chir controlled by state forest division is substantially high. Similarly Pine dominated forest of Katarmal stored substantially high carbon (174.4 t h^{-1}) compared to that of Chir pine forest (99.5 t h^{-1}) of similar altitude (Rana *et al.* 1989).

The soil carbon storage on the permanent fallow and C&S lands is significantly below the soil carbon recorded in forest areas. The difference is as much as 50 to 75%.

In general carbon pool in all these landuses is low denotes that these sites are highly degraded.

The carbon stock in Reserve forest is double that of the C&S lands and other degraded lands (refer Table 5 of Annexure F).

The resultant increase in biomass from project intervention will also impact the adjoining forest areas positively increasing the biomass density in these areas and, hence, the carbon sequestration. Singh et. al. 1985 have shown that centre Himalayan forests are the net contributor to global carbon balance. As per their estimates Carbon storage by the poor, medium and good forests ranges between 43.2 - 92.8, 92.8 – 162.4 and 162.4 - 278.6 t/ha and in soils it ranges between 14.3 – 31.0, 31.0 – 53.6, 53.6 – 92.2 t/ha respectively. The values obtained from project sites lie between the poor and medium forest cover. The existing poor and medium forests should be allowed to attain the good status to put back under plantations and management systems to sequester access atmospheric carbon as wood. Therefore, comparison of forest biomass status as referred in the study (Singh et. al. 1985) to that of forests of the project area clearly indicate that these forests are still potential sink of CO_2 and offer great opportunity for further sequestration of CO_2 under a comprehensive management plan.
(ii) Biodiversity

Detailed Costs
Table 2 below gives the full cost for the project, the contribution from the State Government, Village Level Bodies and Co-financers, and the GEF Contribution being requested through this proposal. The incremental costs have been worked based on the underlying state/central interventions aimed at rural development and ecological maintenance. The principles governing the incremental costs are outlined below:

(i) The present schemes being implemented in the state for conservation of forest area address the plantation and other protection measures in the forest areas either managed by the forest department or under Joint Forest Management.
(ii) The social fencing concept whereby the villagers are paid for protecting the forests from fires as well as illegal extraction is restricted to JFM areas. other village commons are covered under these schemes.

(iii) Presently C&S lands are owned by the Revenue Department but the funds for implementation of activities in these are allocated to the Forest Department. The funds allocated are only for plantation activities where the village community that benefits from these forests contributes the labour cost.

(iv) There are no funds allocated for either micro-planning for regenerating or maintaining the C&S lands and neither do funds allocated address the soil and water conservation measures or growth of horticulture/medicinal plants under these schemes.

(v) There are funds allocated for demonstrating and propagating local nurseries to supply good quality raw material for plantations of trees, grasses, medicinal plants or horticulture trees. Though the capacity of existing government nurseries is limited and also the distance factors affects use of these nurseries for sourcing material. These nurseries will be established on private lands and as such would act as source of income. Therefore the profitability of these activities should govern the incremental costs. Since these are activities with which neither the farmers are familiar and nor assured of the markets, the initial investments in hardware would have to be supported. The participants would provide labor and other non-cash inputs.

(vi) The extension schemes for alternatives on private agriculture lands are restricted to providing information currently or supplying seeds at subsidized costs, even that is not available in case of medicinal plants. Since the models being demonstrated are viable and proven, the profitability of operations will cover the initial investment. But two factors affect this investment on part of farmers, high risk averse behavior coupled with lack of familiarity and lack of information on, and in some cases, funds. The cash expense would therefore is the incremental cost provided by GEF to the project. This is true in the livestock sector too.

(vii) The present development schemes and other environmental conservation schemes do not provide for capacity building and also institutional development (in case of this project to increase the access to appropriate information). These are important barriers to sustainability and replicability of sustainable development. The cost of providing training and developing necessary curriculam and documents is the increment cost. The infrastructure of the Government in providing such training would contribute towards the hardware costs.

Detail Project Budget (US $)

Sl No	Output	Total Cost($)	Baseline($)	GEF($)
1.1	Identification of Policy and legal obstacles	80438	0	80438
1.2	Advocacy of identified policy and legal measures	26088	0	26088
2.1	Establishment of appropriate institutional mechanisms with emphasis on gender balance	88046	0	88046
2.2	Capacity building of stakeholders in institutional, managerial and technical aspects of sustainable management of resources	319565	78370	241195
3.1	Demonstration of sustainable land use models including soil and moisture conservation measures on Civil & Soyam lands	1595870	574391	1021479
3.2	Demonstration of sustainable land use models including soil and moisture conservation measures on private agriculture lands	2571739	1175543	1396196
3.3	Demonstration of improved livestock management techniques	254839	167130	87709
3.4	Identification of innovative market development models and establishment of participatory marketing mechanisms	152174	0	152174
3.5	Self help groups established for women's empowerment	95434	23858	71576
4.1	Establishment of functional participatory monitoring mechanism	91305	0	91305
4.2	Participatory monitoring of Biodiversity status	17392	0	17392
4.3	Developing database for estimating carbon sequestration	26087	0	26087
5.1	Preparation of packages for promoting integrated IVAE approach based on the demonstrations carried out	195656	39130	156526
5.2	Preparation of extension strategy for dissemination of information	86959	4347	65219
5.3	Dissemination of extension packages	65219	8695	56524
5.4	Replication of IVAE approach in other areas of Uttaranchal state	0	0	0
Project administration and management		782609	586956	195653
Project total cost		**6449420**	**2658420**	**3773607**

ANNEXURE B - LOGICAL FRAMEWORK ANALYSIS

Hierarchy of objectives or strategy	Verifiable indicators	Means of Verification	Critical Assumptions
Global objective: To conserve globally significant Himalayan biodiversity and enhance carbon sequestration through IVAE approach	• Change in diversity indices (richness and abundance) over baseline scenario. • Significant increase in amount of carbon sequestered over baseline scenario by assimilation in standing biomass and soil by Y5	• Independent estimates and participatory monitoring report • Independent estimates and carbon database prepared	• Timely policy support by the government for IVAE approach • Macro-economic stability • Ensured participatory social fencing
Specific objective: To enhance local environment through application of IVAE approach for optimizing land utilization, reducing land degradation and ensuring sustainable livelihood to rural communities in Uttaranchal hills.	• A sizable increase in vegetation cover in Civil and Soyam lands over baseline scenario by Y5 • A measurable increase in soil carbon content over baseline scenario by Y5 • Private fallow decrease by 50 % by Y3 • Drop in the number of cases of illicit fodder and fuel wood extraction from reserve forests • Significant change in Ground Cover in Reserved forests by Y5. • Enhanced income for 50 % households through interventions by Y5.	• Participatory monitoring reports and independent sample estimates in IVAE. • Soil analysis in IVAE. • Survey reports and direct observations • Departmental records for forest offences. • Participatory monitoring. • Sample household survey	
Immediate objective 1: To identify policy and legal barriers in adoption of integrated IVAE approach and advocate appropriate measures	• Reports on policy and legal barriers prepared by Y1 • Policy makers and Opinion building workshops organized by Y1	• Policy report • Workshop proceedings	• The current policy and legal mechanism are not entirely conducive for IVAE approach • The government respond positively to the recommendations

Hierarchy of objectives or strategy	Verifiable indicators	Means of Verification	Critical Assumptions
Output 1.1 : Policy and legal obstacles in adoption of integrated IVAE approach identified	• Study for conducive policy and legal changes for sustainable management of C&S forests completed by Y1 • Study for conducive policy and legal changes for promotion of agroforestry completed by Y1 • Study for conducive land tenancy laws completed by Y1	• Study report • Study report • Study report	
Output 1.2 Identified policy and legal measures advocated	• Six opinion building workshop organized by Y1.5 • Eight local advocacy meetings organized by Y1.5 • Minimum two articles published in local language	• Workshop proceedings • Minutes of meetings • Newspaper clippings	
	[redacted]		[redacted]
Immediate objective 2:To establish appropriate institutional mechanism to operationalise integrated IVAE approach	• Participatory management of resources in place by Y3	• Focus group discussion and Independent observation	• *The institutional* mechanisms complement the mechanism already existing under other projects • The training are of … respective stakeholder • Adequate human and infrastructural facilities exists for conducting training
*Output 2.1 Appropriate institutional mechanisms established with special **emphasis** on gender balance.*	• **56 no of village level committees formed by Y1.5** • Mechanism for equitable sharing of usufructs in place by Y 1.5 • Participation of women in decision making • **Institutional mechanism for livestock development** in place by Y1.5 • Identification of actively involved and locally acceptable NGOs.	• Direct observation • Focus group discussion • Focus group discussion • **Direct observation**	

Hierarchy of objectives or strategy	Verifiable indicators	Means of Verification	Critical Assumptions
Output2.2 Capacity of all stakeholders built in institutional , managerial and technical aspects of sustainable management of resources	• Three TOT on microplanning organised by Y1 • 12 training on microplanning organized for village community by Y1.5 • 24 trainings on institutional governance organized by Y1.5 • 24 technical trainings for agroforestry adopters organized by Y1.5 • 15 local youths trained as para -veterinarians by Y1.5 • 12 trainings organised in various GEF interventions for beneficiaries by Y2 • Eight NGOs trained on information sourcing and networking for IVAE approach by Y1	• Training reports , feed back forms and records with project implementation office • Manuals on project activities prepared.	
3. To demonstrate models for sustainable management of private as well as common access land resources and improvement of livelihood status of rural community	• 1400 ha of demonstration area established increasing the biodiversity and productivity in at least 3500 Ha of C&S forests by plantation of trees, medicinal plants, bamboos and fodder species in the area by Y5 • 1680 ha of demonstration area established in private lands to increase production of fuelwood, medicinal plants and grasses by introduction of appropriate trees and herb species in 4000 ha areas by Y5	• Direct observation and group discussion • Direct observation and sample household survey • Ground verification • External project audit • Semi annual inspection reports	• Adequate institutional development and capacity development preceded
Output 3.1 Sustainable land use models including soil and moisture conservation measures on Civil & Soyam lands demonstrated.	• Microplans prepared for interventions in C&S forests by community by Y1.5 • Minimum of 1400 ha of C&S rehabilitated by introduction of trees, bamboo, grasses and medicinal plants (including soil and moisture conservation) by Y4 • 40 % increase in fodder availability by Y5 (over	• Microplan document • **Direct observation**	• Adoption of technological packages by the community • Inter-sectoral coordination in

Hierarchy of objectives or strategy	Verifiable indicators	Means of Verification	Critical Assumptions
	baseline scenario)		place
Output 3.2 Sustainable land use models including soil and moisture conservation measures on private agriculture lands demonstrated	• Agroforestry adopters identified by Y1.5 • Minimum of 1680 ha of private land brought under agroforestry by introduction of fodder, fuel, fruit, tree and cultivation of medicinal plants by Y5 • 50 % increase in income over traditional management in least 90% cases by Y5 (over baseline scenario)	• Microplan and records with project implementation office • Direct observation • Focus group discussion and sample household survey	• Adoption of technological packages by the community • Supportive market structure
Output 3.3 Improved Livestock Management techniques demonstrated	• Beneficiaries identified by Y 1.5 for intervention in livestock sector • 50 % of households with improved bovines by Y5 • Four Livestock demonstration and production unit established by Y4 • 8 Para-veterinarian units established	• Microplans and records with project implementation office • Sample household [illegible] and focus group discussion • Direct observation	• Adoption of technological [illegible] the [illegible] • Animal Husbandry department plays a pro-active role
Output 3.4 Innovative market development models identified and participatory marketing mechanisms evolved	• Study on successful market models completed by Y 2 • Marketing information system in place by Y2.5 • Four collection centre/storage/processing units in place by Y4	• Study report • Direct observation • Direct observation	• Sufficient production of horticulture produce, honey, medicinal plants. • Adequate Govt. support.
Output 3.5 Self help groups established for women's empowerment	• Minimum of one women self help group formed in each village by Y2	• Focus group discussion and sample household survey • Direct observation and records with project	• Financial support from current government schemes for Women's development

Hierarchy of objectives or strategy	Verifiable indicators	Means of Verification	Critical Assumptions
		office	continues • Women adopt income generating activities recommended under GEF scenario.
Immediate Objective 4: To conduct monitoring and evaluation for adaptive management	• Mid-course corrections for shortcomings initiated	• Physical verification • Group discussion • Records at the project implementation office	• Capacity of village community built adequately for undertaking monitoring and evaluation and documenting • People feel empowered in realistic participatory monitoring and evolution.
Output 4.1 Functional participatory monitoring mechanism established	• **Participatory monitoring mechanism in place in each** village and 56 groups formed by Y1 • **First monitoring report of implementation of planned project activities prepared by Y2 and then at intervals** of one year.	• Direct observation, Focus Group Discussion, records at the project implementation office • Physical verification of monitoring repots	
Output 4.2 Biodiversity status monitored through participatory approach.	• Biodiversity inventory prepared by Y2 and updated very year thereafter	• Physical verification of inventory, documents at the Project implementation office	
Output 4.3 Database for estimating carbon sequestration developed	• **Framework for database prepared by Y1** • Database updated every year starting from Y3	• Physical verification of data base, documents at the Project implementation office	
Output 4.4 Enabled Adaptive management	• **Adaptive management operational by Y1**	• Focus group discussion and documents at project implementation office	

Hierarchy of objectives or strategy	Verifiable indicators	Means of Verification	Critical Assumptions
Immediate objective 5 To develop and operationalise extension strategy to facilitate dissemination and replication of IVAE approach	• Strategy operational by Y5 and information dissemination started as early as Y1	• Direct observation and records at project implementation office	Support from other government departments in disseminating information
Output 5.1 Packages for integrated IVAE prepared based on the demonstrations carried out	• Packages including audio-visual packages prepared by Y5	• Physical verification of packages and documents at project implementation office	
Output 5.2 Extension strategy and enabling institutional mechanism for dissemination of information in place	• Strategy in place and tools prepared by Y5	• Physical verification of strategy document and tools	
Output 5.3 Extension packages disseminated	• 14 no. of workshops and meetings organized to disseminate project leanings and packages by Y6 • Extent of coverage through mass media • Regular networks established and exposure visits from other areas organized to project sites from Y5 onwards	• Workshop proceedings and minutes of meetings • Clippings and records with the project implementation office • Documents at the project implementation office	
Output 5.4 IVAE approach replicated in other areas of Uttaranchal state	• Farmers motivated in new areas • Microplans for IVAE prepared in new villages • Demonstrated interventions adopted in new villages	• Records of Project Directorate • Physical verification • Physical verification	

Annexure C – Project Activities and Financing Plan

Activities	Financing arrangement
1.1 Identification of Policy and legal obstacles in adoption of integrated IVAE approach	
1.1 1Identify policy and legal constraints on community based management and utilization resources from C&S forests and suggest remedial measures	GEF
1.1.2 Identify policy and legal constraints on agro-forestry development and suggest remedial measures	GEF
1.1.3 Identify policy and legal constraints towards sustainable utilization of wood and non-wood products from private lands and recommend remedial measures	GEF
1.1.4 Identify lacunas in the current land tenure systems and recommend amendments amenable to rehabilitation of deserted private lands(fallows) and suggest remedial measures	GEF
1.2 Advocacy of identified policy and legal measures	
1.1.2 Advocacy/opinion building of recommended policy and legal measures for rehabilitation of C&S lands	GEF
1.2.4 Advocacy/opinion building of proposed policies and legal measures for promotion of agroforestry in private lands	GEF
2.1 Establishment of appropriate institutional mechanisms with special emphasis on gender balance	
2.1.1 Build up from existing experience of JFM/Village Panchayat and indigenous management systems for institutional management of C&S	GEF
2.1.2 Establish participatory institutions for management of C&S lands	
2.1.3 Identify reputed locally acceptable NGOs	GEF
2.1.4 Link up with existing infrastructure of Animal Husbandry and local governance departments to provide veterinary services through trained para-veterinarian and NGOs	State Govt. GEF
2.1.5 Link up with private sector to provide information and training to farmers for poultry and angora rabbit rearing.	GEF
2.2 Capacity building of stakeholders in institutional , managerial and technical aspects of sustainable management of resources	
2.2.1 Conduct training of trainers in microplaning and IVAE approach	GEF
2.2.2 Train village community in microplanning, institutional governance and technical aspects of rehabilitation of C&S lands	GEF & State Govt.
2.2.3 Train village community/village institutions in participatory monitoring and evaluation (including enumeration of biological resources)	GEF.
2.2.4 Train identified farmers on all aspects of agoforestry (including exposure visits)	GEF & State Govt.
2.2.5 Train identified village based youths as para- veterinarians	GEF

Activities	Financing arrangement
2.2.6 Train of identified beneficiaries for livestock production programme	GEF & State Govt.
2.2.7 Train people in weaving of angora wool and developing products.	GEF , State Govt.& Community
2.2.8 Train relevant stakeholders including state government departments in IVAE approach and in GIS based planning and monitoring of project activities	GEF & State Govt.
2.2.9 Train identified NGOs in sourcing information on various developmental activities and networking	GEF
3.1 Demonstration of sustainable land use models including soil and moisture conservation measures on Civil & Soyam lands	
3.1.1 Prioritize technical options for management of Civil & Soyam land from the menu of short-listed packages in consultation with institutions identified	Included in activity 3.1.2
3.1.2 Develop micro-plan for management of Civil & Soyam land	State Govt.
3.1.3 Demonstrate models for rehabilitation of C&S lands	GEF , State Govt.& Community
3.2 Demonstration of sustainable land use models including soil and moisture conservation measures on private agriculture lands	
3.2.1 Identify interested farmers for demonstration of agroforesty models	Included in activity 3.1.2
3.2.2 Prioritize agroforestry (inclusive of horticulture) models from the menu of short-listed packages in consultation with village community	Included in activity 3.1.2
3.2.3Demonstrate agroforestry models	GEF & Community
3.3 Demonstration of improved livestock management techniques	
3.3.1 Identify beneficiaries for introducing improved breed of bovines	Included in activity 3.1.2
3.3.2 Implement livestock intervention models for bovines	GEF State Govt.& Community
3.3.3 Identify locations and beneficiaries for specific livestock production demonstration units	Included in activity 3.1.2
3.3.4 Implement livestock intervention models for production units	GEF , State Govt.& Community
3.4 Identification of innovative market development models and establishment of participatory marketing mechanisms	
3.4.1 Study various in-place marketing models to develop participatory marketing mechanism	GEF

Activities	Financing arrangement
3.4.2 Establish forward linkages with institutions for market information for the marketable produce and backward linkages for information dissemination at village level	GEF
3.4.3 Build capacity of local governance institutions in market information, institutional linkages and database maintenance	GEF
3.4.3 Identify and establish mechanisms for post-harvest operations such as grading, processing and local storage by enhanced involvement of women and blending of traditional knowledge.	GEF
3.5 Self help groups established for women's empowerment	
3.5.1 Analyze role of women in socio-economic structure of village	GEF and State Govt.
3.5.3 Identify and promote self help groups	GEF and State Govt.
4.1 Establishment of functional participatory monitoring mechanism	
4.1.1 Establish mechanism for participatory monitoring and evaluation of project activities	GEF
4.1.2 Undertake participatory monitoring and evaluation(concurrent , mid-term and terminal) of project activities planned and implemented	GEF
4.1.3 Conduct midterm and terminal evaluation of project activities, process and impacts by an independent external agency	GEF
4.2 Participatory monitoring of Biodiversity status	
4.2.1 Prepare inventory of fauna and flora	GEF
4.2.2 Conduct periodic monitoring of change in biodiversity status	GEF
4.2.3 Update inventory	GEF
4.3 Developing database for estimating carbon sequestration	
4.3.1 Collect field data	GEF
4.3. 2 Create data base	GEF
4.4 Adaptive management	
4.4.1 Analyze results of monitoring and evaluation	GEF
4.4.2 Redirect project activities based on results of monitoring and evaluation	GEF
5.1 Preparation of packages for promoting integrated IVAE approach based on the demonstrations carried out	
5.1.1 Document successful models in all sectors of intervention leading to integrated management of VAE	GEF & State Govt.
5.1.2 Audio-visual documentation of successful models in all sectors of intervention	GEF & State Govt

Activities	Financing arrangement
5.1.3 Document project learning, outcomes and impacts based on the results of monitoring and evaluation	GEF & State Govt
5.1.4 Prepare packages for other areas of Uttarancahal	GEF & State Govt
5.1.5Document global benefits like carbon sequestration and biodiversity conservation	GEF & State Govt
5.2 Preparation of extension strategy for dissemination of information	
5.2.1 Analyze the current flow of information and institutional mechanism	GEF & State Govt
5.2.2 Design and establish strategies for continuous flow of information to the village community including enabling institutional mechanism	GEF & State Govt
5.2.3 Design and field test innovative tools for dissemination of information	GEF & State Govt
5.3 Dissemination of extension packages	
5.3.1 Organize workshops/seminars to disseminate project learning, outcomes and impacts	GEF & State Govt
5.3.2 Establish regular networks for dissemination	GEF & State Govt
5.3.3 Organize exposure visits project areas	GEF & State Govt
5.3.4 Disseminate information through mass media	GEF & State Govt
5.4 Replication of IVAE approach in other areas of Uttaranchal state	
5.4.1 Facilitate motivational activities in new villages	GEF
5.4.2 Establish tie -ups with financial institutes, markets and trained personnel	GEF
5.4.3 Provide logistical support to new villages to facilitate replication of the IVAE approach	GEF

ANNEXURE D - STATUS OF BIODIVERSITY IN UTTARANCHAL

The state of Uttaranchal has three physiographic regions namely mountainous Himalayas, the Sivaliks and the plains. Two major '*hotspots*' of biodiversity significance viz, Kumaon-Garhwal Himalaya and Siwaliks are represented. The region has four priority centres for characterization of '*microhabitats*' with species and genetic diversity, e.g. Kedarnath, Nandadevi, Siwaliks and Terai. There are eight catchments, 26 watersheds and 1,120 microsheds. The region has six National Parks, six Wildlife sanctuaries, one Biosphere Reserve and one UNESCO World Heritage Site. The forest cover is 23,260 sq.km, i.e. 43.5percent of the geographical area of the state. Thirty-five different sub-types of 6 major forest types are represented in the region. Agricultural land covers 12.05percent of the state. The state is divided into four agro-climatic zones, for example, subtropical (up to 1000 m), warm temperate (1000 - 1800 m), cool zone (1800 - 2400 m) and cold zone (2400 - 3000 m). As per the Year 2001census the population of the state is 8,479,562. The male is 16.04 percent and female 15.06 of population.

The project area is unique with spectacular plant groups such as conifers, rhododendrons, *Quercus* (oaks), *Acer* (maples), *Berberis, Primula, Saxifraga, Saussurea*, orchids, *Hypericum, Impatiens* etc. The region has mixture of Indo-Malayan, European, Sino-Japanese, Mediterranean and African elements. These elements through intermixing have produced enormous variability; also through the processes of mutation, recombination and subconscious/conscious selection. The region is a secondary centre for a number of important plants, notable among them are the species of mountain bamboo, conifers, *Dalbergia, Acacia, Albizia*, oaks, *Rhododendron*, *Shorea* (sal) etc. The region is endowed with rich flora and fauna. Some areas have high floristic richness, for example, Kedarnath Forest Division has 555 species of plant species distributed in 32 sq.km of the area in temperate zone.

The fish diversity of the region is comprised of 83 species, out of which 30 fall under different categories of threats.

The region has contributed to the total crop plant genetic resource. Many of the species of such resource, for example, cereals, millets, pulses, oil yielding and vegetable yielding elements form the major components of traditional agro-ecosystems. Field explorations have been carried out with a view to inventorying the wild land races of plants grown in the village eco-system of several villages of the state. For example, Jardhargaon in Tehri district has 140 varieties of *paddy* (rice), 10 of wheat, 35 millets and 150 of *rajma* (soybean) occur in the present area of investigation.

It is found that 350 species of subsidiary food/vegetable, 50 fibre and cordage, 100 fodder yielding, 20 biopesticidal species, 200 species of well known aromatic and medicinal flora, bamboos and grasses, wild and cultivated ornamental species of horticulture value such as orchids, barberries wild roses, primulas, zingibers etc. occur in the environs of project area.

LOSS OF BIODIVERSITY AND GENETIC RESOURCES

The proximate causes of the loss of biodiversity are due to destruction of habitat, land degradation, over- exploitation, introduction of exotic species, biological invasion, deforestation, overgrazing, replacement of local varieties, changing agriculture systems, lack of land use policy and awareness among the people towards the preservation and conservation of biodiversity and genetic resources. Besides, the endemic nature and disjunct distribution of several groups of life forms and species have resulted in their loss. It is also well known that the rural populace visits urban markets to sell traditional wild plant and animal products of potent medicinal and high-energy values.

The destruction of habitat is mainly caused by overgrazing, forest fire, overexploitation of fuel wood species, road construction on fragile and sensitive geological formation, dam building, mining, industrialization, etc. As a consequence of this, the flora and fauna must adapt to the changes, move elsewhere or succumb to predation, disease and eventually

vanish. Construction and development activity in and around the catchment areas and disposal of domestic waste as well as sewage has accelerated the rate of eutrophication affecting the quality of natural water bodies.

The state of Uttaranchal is endowed with a rich array of fauna. The one an integral part of forest ecosystem. They are inter connected with the environment through biogeochemical cycles such as the water cycle, carbon, nitrogen and mineral cycles. The fauna, both wild and domesticated, recycles essential elements of the nature. The region is a corridor for several agents responsible for the habitat destruction, pollution, poisoning, hunting and poaching. Varying degrees of threats have forced much of the fauna of the state of Uttaranchal to the brink of extinction. Nearly 28 percent of mammalian, 30 percent of reptiles and 30 percent of birds are threatened. Among the reptiles Gharial, *Crocodylus porous*, King Cobra, Lizards, Indian rock python are endangered. Other species of the state falling under different IUCN categories of threats are: Asiatic elephant, Indian Pangolin, Lynx, Pallas Cat, Panther, Snow Leopard, Tiger, Blue Sheep or Bharal, Himalayan Brown Bear, Sloth Bear, Musk Dear, Swamp Dear, Tibetan Gazelle, Himalayan Tahr or Mountain goat, Hispid Hare and Markhor. Among the endangered birds Himalayan Monal pheasant, Cheer Pheasant and Himalayan golden eagle. Mountain quail (*Ophrysea superciliosa*) once found in parts of Uttaranchal (Mussoorie and Nainital environs) was last observed in 1876; the species is now 'presumed extinct'.The piscean diversity of the state is represented by as many as 30 species of fish, out which 20 species fall under different categories of threat. Numerous species of butterflies and moths of *Amathusildae, Danaidae, Nymphalidae, Papitiomidae, Satyriedae* etc of the region are specified under the Wildlife (Protection) Act of the country.

The invasion of gregarious and obnoxious weeds such as *Eupatorium,, Lantana, Parthenium, Erigeron, Tithonia* etc have invaded the microhabitats of biodiversity rich sites.

Local and indigenous varieties of plant and domesticated breeds are being replaced by high yielding and productive species. Mining in the region has had an adverse impact on the composition and interdependence of biodiversity.

Total neglect of traditional crop species at the cost of high yielding varieties is also one of the causes. It is understandable that farmers have given up cultivation of most of the traditional crop varieties in the state of Uttaranchal. The importance of their *in situ* and *ex situ* conservation cannot be minimized or ignored.

Among the rare and vulnerable plants, over 400 species distributed among 250 genera representing nearly 90 families are known to occur in different localities of significance in Uttaranchal.

There is lack of awareness towards the preservation of indigenous elements of biodiversity and genetic resources. There is, therefore, a need to study the interrelated issues concerning the farmer's rights on biodiversity from the perspectives of WTO, IPR and benefit sharing.

INDIGENOUS KNOWLEDGE AND ECONOMIC IMPORTANCE

Indigenous knowledge of the region is as old as its cultural history. An appreciable proportion of the floristic component of biodiversity in this area is used by indigenous communities for a variety of value-added products such as food, fodder, fiber, gum-resins, bamboo, medicinal herbs etc. Various indigenous groups have accumulated considerable knowledge about the use of biodiversity due to their constant and intimate association with the environment.

Indigenous knowledge (IK) on various aspects of biodiversity covering the indigenous or traditional methods of selection of species, farming, propagation etc. remain by and large un/under-explored and un/under-utilized. The knowledge on cultivation, utilization and management of species of socio-economic significance is little or less known. This may be due to non-accessibility, lack of scientific data for adopting technology and immediate

application. IK has been tapped from communities to yield benefits in the form of gathering scientific data for commercial/non commercial gains. Yet, the potential of numerous species with regard to their uses has not been fully realized, scientifically researched and documented. The benefits of indigenous knowledge need to be addressed with reference to equitable sharing.

Uttaranchal region is extremely rich in medicinal plant species. Due to the close involvement of indigenous communities with the flora of the region for use in a value-added product, their domestication and man-made dispersal have improved the status of many species.

MEDICINAL FLORA OF UTTARANCHAL

Bioclimatically and phytogeographically the medicinal flora of the state has occupied specific micro-habitats. The area and extent of occupancy are largely due to various abiotic and biotic influences.The succession trends are largely based upon various influencing factors.

The most significant elements (with their common names in parenthesis) are mentioned below in order to highlight the species diversity of the medicinal flora of Uttaranchal. It should be mentioned that the remnants of once luxuriant flora of this group of economic important species of the region has taken refuge in ecotones of different anthropogenically influenced land use patterns.

Aconitum heterophyllum (Ativis, atis), *Angelica glauca* (Cora, Grandrayan, Chipi), *Atropa acuminata* (*Angur sefa, Sagangur*), *Bunium persicum* (Siah jeera), *Colchicum luteum* (suranjan siri), *Dactylorhiza hatazırea, Orchis habernarioides* (Salam panja, Salab, Hathajari), *Fritllaria roylei* and *Lilium polyphyllum* (Kakoli, Kshir-Kakoli), *Gentiana kurroo* (Karu), *Hedychium spicata* (Kapur Kachri, Kachur), *Jurinea* spp. (*Dhup, Guggal*), *Nardostachys jatamansi* and *N. grandiflora* (Mansi, Jatamansi), *Onosoma bracteata* and *Macrotomia benthami* (Gaujuban and Ratanjot), *Podophyllum emodi* and *P. hexandrum* (Ben-kakri), *Picrorhiza kurrooa* (Kutki, Karu), *Rheum australe* and other species (Dolu, *Revanda chini*), *Saussurea costus, S. lappa* (Kuth, Quest-e-sirin), *Swertia chirayata* (Chirayata), *Valeriana wallichii* or *V. jatamansi* (Asarun, Tagar, Sugandhbala), *Viola odorata, V. canescens* and *V. serpens* (Banafsha, Gulbanafsha).

Table D1. Species richness of some important Himalayan aromatic and medicinal plants with reference to Uttaranchal

Genera	World	Himalaya	Spp. with uses based on IK in Uttaranchal
Aconitum	300	33	5
Artemisia	400	25	3
Atropa	4	1	1
Berberis	450	40	10
Capparis	250	4	-
Colchicum	65	1	-
Coleus (wild)	150	1	-
Coptis	15	1	1
Dactylorhiza (Orchis)	30	1	1
Dioscorea	600	10	3
Gentiana	400	60	5
Inula	200	13	1
Jurinea	100	2	1
Nardostachys	2	2	1
Picrorrhiza	2	2	2

Genera	World	Himalaya	Spp. with uses based on IK in Uttaranchal
Podophyllum	10	1	1
Rauvolfia	100	1	1
Rheum	50	7	5
Saussurea	400	31	15
Taxus	10	1	1
Valeriana	200	9	1

MICROHABITATS AND PRIORITY SITES FOR BIODIVERSITY CONSERVATION IN UTTARANCHAL.

Based on rich indigenous knowledge on the flora of the state certain specific sites as mentioned below have been demarcated for the purpose of in *situ* conservation of various taxa. The ranges are identified for the purpose of habitat preservation and rehabilitation of little and lesser known species of economic value. The ranges are: Barhat Range (Uttar Kashi), Manora (Nainital), Mamuna Shivpur Range (Mussoorie hills), Chakrata, Ukhimath, Bhilangana Range, Kotikanasar (Chakrata Division), Deoban Ridge & shaddier aspect of Surkunda Devi Hills (Tehri Division), Badkot, Dhanaulti & Gangnani Ranges, Mandal Forests, Palam valley etc.

There is a need to undertake targeted activities with long and short term objectives to carrying out studies on threatened biodiversity in different land use patterns, integration of available database related to inventorization, characterization and sustainable management ranging from grassroots innovation to collection of germplasm of potential land races and breeds for introduction and establishment of site-cum-species specific niche. Gender analysis initiatives with regards to biodiversity management on the basis of time tested and traditionally adopted components would be useful in developing a strategic plan for the socio-economic development of Uttaranchal.

ANNEXURE E - AGROFORESTRY IN UTTARANCHAL

NEED OF AGROFORESTRY

It is now widely believed that tree farming holds the key to rural development for its potential to harness both rural man power and land resources for biomass production. The programme benefits almost all section of rural society, be they landless people, the small and marginal farmers, village artisans, etc. Various forestry operations i.e., tree planting, tending, protection, felling, conversion, collection of grasses, leaves, twigs, fruits and seeds and processing of wood etc. are all labour intensive operations and benefit the poor man by providing sufficient employment opportunities. All the rural development programmes emphasize self-sufficiency for villages and the generation of surpluses through commerce to improve rural economy. It is therefore, necessary to strike a balance in the existing land use to enable produce sufficient amount of food, fuel, fodder and timber along with agricultural goods. Agroforestry, the land use system that incorporates woody perennials with agricultural and animal husbandry ensures ecological security for food production. This system has been recognised as an important land use system for India, where land for sustained essential production of goods e.g. food, firewood, timber, fodder, oil seeds, industrial materials on a sustained basis or for rural-urban dwellings has been a big constraint.

The National Forest Policy 1988 *inter alia* stated that "the forest-based industries should, as far as possible, raise their own raw materials, preferably by establishing direct relationship with individuals who can grow these". A positive development of this policy has been that many forest-based industries, with assistance from financial institutions, have encouraged farmers and private tree growers to plant trees on their farmlands. Some wood based industries like WIMCO, ITC Bhadrachalam, etc. are increasingly relying upon farmers to raise raw material on their fields.

CURRENT AGROFORESTRY SYSTEMS

Uttaranchal has a long tradition of agroforestry, which is widely practiced, in all ecological and geographical regions. Traditional agroforestry systems are broadly based on indigenous knowledge and the species are selected as a part of the cultural patterns of the community. The farmers and landowners in different parts integrate a variety of woody perennials in the crop and livestock production systems depending upon the agro-climatic conditions and local requirements. Table 1 summarizes the major types of agroforestry systems and their benefits in different agro-ecological zones. Himalayas is an excellent example of the commercial but traditional agroforestry systems. The growing of trees like *Grewia, Celtis* etc., on field bunds and systematic plantation of shade trees for tea and coffee plantation are other common examples of agroforestry practices. Understanding local tree-use practices is a pre-requisite for formulating economically viable and environmentally non-degrading agroforestry systems.

Table E1. Major types of agroforestry systems

Types of agroforestry systems	Major benefits	Examples
I. Himalayan Region		
1. Trees in agricultural fields or on field bunds	Production of food, fruits, fodder, etc. and stabilization of bunds.	*Grewia optiva* and other trees
2. Intercropping in fruit orchards.	Production of fruits, food etc.	Orange and other citrus, and guava intercropped with cereals, tuberous and rhizomatous crops.
3. Silvopastoral practices (fodder trees with pastures)	Fodder, fuelwood etc.	Tree leaf fodder from *Grewia, Celtis* and other species.
II. Indo-Gangetic Plains		
1. Trees for soil Reclamation(sodic/ saline/ degraded Soils)	Reclamation of degraded lands, production of fuel and fodder.	*Prosopis chilensis, Acacia nilotica, Parkinsonia aculeata* and other species for problem soils.
2. Fodder trees in degraded grazing lands.	Fuel, fodder, Timber	*Albizia lebbek, Bauhinia purpurea, Dalbergia sissoo* and other tree species on grazing lands.
3. Trees on boundaries of agricultural fields.	Fuel, fodder, timber, shade, cash, minor products.	*Populus, Tamarindus indica, Bombax ceiba, Eucalyptus, Dalbergia sissoo*, etc.
4. Fodder banks and woodlots.	Fodder, soil Conservation, fuel etc.	*Azadirachta indica, Melia azaderach, Albizia spp., Syzygium cuminii* etc. fodder trees. *Casuarina equisetifolia, Eucalyptus*, Bamboos, *Dalbergia sissoo* etc. woodlots.

Constraints in Adopting Agroforestry

Marketing in its technical sense has not been developed for products in India. In fact, the situation of the forest sector in India is one of 'Market failure'. Traditionally the government has been the only major producer of timber and therefore an infrastructure for open and free timber market could not develop. Considering the scarcity of wood raw material and in order

to ease the situation in processing industries, the government was released the trade barriers and liberalised imports. With timber being imported in sizeable quantities and with growing number of private tree growers in certain regions, timber markets in a few locations have grown. This policy change has led to increased imports of timber and forest products but has adversely affected the local market prices thereby acting as a disincentive for farmers to develop agroforestry plantations. Some mechanism needs to be evolved to declare support price for plantation grown timber and timber products.

After achieving massive plantation programme under agroforestry, there would be sizeable wood resources available in this sector. It would be imperative to allow plantation-grown timber to be exported outside the state/country. This would help farmers get more benefits. An information network of important markets of wood and other forest products should be created. Farmers should also be encouraged to create co-operatives to deal with industries and other bulk buyers of wood products.

Nearly all the states including Uttaranchal have some sort of restrictions on felling of trees even from the private areas. In addition, transit rules are applicable to movement of wood. The tree growers, while planning to fell and sell their trees, often find the procedures quite harsh, lengthy, costly and frustrating. This invariably acts as a major disincentive to growing trees for commercial purposes in the private areas. There is an urgent need to reform related legislation and simplifies procedures concerning felling trees and transporting wood.

PROSPECTIVE MODELS

Uttaranchal's rural landscapes mirror both the traditional and new agroforestry models. Many agroforestry systems have been existence in the different regions since time immemorial. Technical and scientific innovations enabled development of modern agroforestry models that ensure high income to the farmers. Some of these systems incorporate, poplars and eucalyptus with agriculture. Poplar and eucalyptus based agroforestry is highly profitable, generating handsome income to the farmers as the timber produced from these systems supports the packaging industries for vegetable and horticultural products produced in the hilly regions. It also meets the raw material needs of some of the match-stick, veneers and pulp industries in the region.

Four broad plantation models practiced under agroforestry are (i) boundary planting (ii) block planting (iii) row planting and (iv) windbreaks & shelterbelts. In the first model, trees are planted around the field in single row along the boundary at a spacing of 2 to 3 metre. In the second model, the trees are planted all over the cultivated field at wide spacing which may vary from 4x5 m to 5x6 m. In the third model, trees are planted in rows at wider spacing between rows of 8m to 10 m an between trees 3 to 4m. The objective of the fourth model i.e., windbreak and shelterbelt plantation is to reduce wind velocity and improve the microclimate on the leeward side with a view to checking soil erosion and maximizing agricultural yields.

The tree and crop species are chosen in such a way that there is minimal adverse interaction. Depending upon the model, size, configuration of the farm and the tree species, 100 to 500 trees can be planted in one hectare of agricultural land under agroforestry.

POLICY ISSUES VIS-A-VIS AGROFORESTRY

Non-forest lands are generally under private ownership. It would be imperative for the government to create the necessary policy environment to enable large scale planting activity to be taken up in non-forest lands so that private tree growers are assured of remunerative prices. The afforestation programme in the private sector cannot be successful without the help and cooperation of the government. Help in the form of quality seedlings, agroforestry models and extension and demonstration support has to be provided by the government. It is therefore imperative to allocate a budget for raising planting stock, agroforestry research, extension and demonstration.

1. Adequate financial allocation for raising planting stock (Nurseries)

The nursery cost, depending upon species and size, may vary from Rs.1 to over Rs.10 per seedling. Seedlings should not be supplied free but at a highly subsidised price, the extent of subsidy may depend upon the land holding and economic status of the tree grower. The state should utilise the budgetary provision to modernise nurseries so as to improve the quality of planting stock while bringing down its cost of production. In due course, private nurseries will be encouraged to enter the market.

2. Adequate financial allocation for conducting agroforestry research.

Research support in several key areas such as agroforestry, tree improvement, mass multiplication etc is still to be strengthened. It is a continual research process to develop and release new clones / hybrid / varieties of tree species for introduction into agroforestry systems.

3. Adequate financial allocation for extension & demonstration.

Transfer of Technology through extension and demonstration, awareness of value addition, industrial utilisation and multiple uses has to be provided by the government. Value addition takes place in the growing of wood, harvesting, log classification, primary processing, secondary processing, wholesale marketing, packaging and retailing. Harvesting methods of all types of forest products should be improved. Incentives should be provided for ensuring waste free harvest processing technology, product diversification. Innovation of new design and products should be stimulated.

Although farmers may feel tree growing is an easy thing, there is certainly a need to train and educate them on several technicalities by providing training or demonstration to interested tree growers. So far very little input has been given by forestry institutions towards this aspect. Linkages and procedures for transfer of research findings to the user agencies will be developed, tested and demonstrated through training, workshop and engaging NGO's. Systematic co-ordination between ICFRE Institutes, State Forest Departments, Agriculture universities and user target groups has to be developed.

4. Incentives to tree growers

As the tree growing business has a minimum gestation period of over six years, it is more risky and uncertain than agriculture. The agriculture sector provides a lot of security and incentives to the farmers in the form of support price for the final produce, soft loans, writing off of loans in case of natural calamities, etc. Moreover, the government should actively consider provision of crop insurance to the farmers. The private wood producers, on the other hand, are left to the vagaries of fluctuating markets and exploitative middlemen. The state governments or the public sector should provide some kind of support price for timber and wood to the tree growing farmers, subsidized seedlings, tax incentives, liberalization of laws, tie up with industries and R&D support/extension. Similarly, wood based industries, especially those falling within cottage and small-scale industries sector, should be developed and expanded so that farm produced wood finds ready market.

ANNEXURE F - DESCRIPTION OF PROJECT AREAS

SELECTION OF PROJECT SITES

The galaxy of stakeholders present in the project initiation workshop organized on 5 September 2001 at the state capital Dehradun unanimously decided to adopt the watershed as the basic unit for project interventions under GEF scenario. It was also decided that sites would be chosen/identified in two distinct hill regions of Uttaranchal state namely Garhwal and Kumaon for demonstrating and disseminating the project results in the respective region. Within the sub/micro-watershed a cluster of 15 to 20 villages (depending on the geographic spread) would be selected for project demonstration.

At the second stage, during the regional workshop a number of representative sub/micro watersheds was identified in consultation with regional partners and regional Nodal Officer, appointed by the UFD. Following the workshop, rapid visits were made by the Team to identify the particular project sites. In Garhwal, the rapid visit was undertaken on October 18, 2001, while in Kumaon the team visited areas for final selection of sites on November 7 and 8, 2001.

Subsequently, in the Garhwal Himalayas, Irgad micro-watershed in Pauri district has been identified while in Kumaon Himalayas, the sub-watershed of Kosi and Malyal Gad (Almora district) and Lohawati (Champawat district) micro-watersheds have been identified. Being a demonstration project in hilly areas, proximity to the road and easy accessibility were considered as important factors for site selection. The maps (Annexure G3 & G4) present the detail description of the number of villages selected in each sub/micro-watersheds and geographical spread of the cluster on a map for the Irgad and Malyal Gad microwatersheds.

Methodology for the primary survey

The primary survey focussed on four major aspects, viz, socio–economic profiles, animal husbandry, and phytosociological studies and soil analysis to gather information on biodiversity and biomass status, carbon sequestration and livelihood constraints. Ecological, socio-economic and animal husbandry profiles were compiled through phytosociological studies, soil analysis, household survey, group discussion and PRA. While group discussion and PRA were carried out in all selected sites, detailed phytosociological studies, soil analysis and household survey were conducted in one village randomly selected in each cluster. The methodology for phytosociological and soil analysis is given below.

Phytosociological studies

The study was carried out in adjoining forest areas of selected villages. In Irgad catchment the study included two forest patches, one in natural forest and another in plantation areas of village Nishani. Similarly the study included one forest patch in the adjoining areas of Forti village in Lohawati catchment. A walk-through transect was constructed to get a picture of the ecosystem. The nested quadrant method was applied for phytosociological study. In order to study the tree species 19 quadrants of size 10m×10 m (15 quadrants in natural forest and 4 in plantations) in Nishani and 10 quadrats in Forti were laid out along the walk transect at uniform distances. The species-wise data on height of all the trees of 2.5m height and above was recorded. The girth of these trees were recorded at breast height.

In order to study the shrub species quadrants of the size 3m×3m were laid out within the selected quadrants for tree species and data on all the shrubs having height 0.5 m. and above was recorded. Observations were taken on number and collar diameter of shrub species. Similarly, for study of the herbs and grasses, quadrants of size 1m×1m were laid out within each quadrant laid out for tree species and data on all herbs and grasses having height below 0.5 m was recorded.

Soil analysis

The soil samples were collected separately from forestland, agricultural land, fallow land, and homestead garden from each village. For the purpose of collection of soil samples each ecosystem was divided into three strata, upper, middle and lower with respect to altitude and samples were drawn at two depths, 0–15 cm. and 15–30 cm. A composite sample was, made with respect to each category and catchment, out of the samples drawn from each village.

CURRENT ECOLOGICAL STATUS

Ecological status of the forests of project area have been assessed with the help of ecological attributes, that is, Importance Value Index (IVI) and Diversity Index. IVI was calculated by quadrate method and diversity index was studied by Shannon Weiner Index. These attributes provided the quantitative value for comparison of species organization within the system and among the systems. High value of IVI in all the layers of particular system confirms the population distribution from young to old and reflect the good regenerating capacity. These regenerating forests have tremendous potentialities for carbon mitigation, if protected and subsequently followed by silvicultural operation in terms of canopy opening to provide the space for the younger population. The ecological status of different project sites is described below:

(i) Importance Value Index (IVI)

Katarmal Village

The IVI data (Table1) indicates existence of a dense forest dominated by *Quercus leucotrichphora* (ban oak) in the past. Over utilization of oak beyond its carrying capacity, has gradually altered the physico-chemical properties of soil, particularly the texture and water holding capacity turning the conditions more xeric and suitable for the pine (*Pinus roxburghii*). This habitat is highly favourable for aforementioned species as indicated by the presence of seedling and sapling population.

Aaina, Kuwala, Phagsa, Adhuriya, Dayuna and Biralya villages

Van Panchyat forests of these villages are dominated by *Pinus roxburghii* having a good regeneration status. The forests are young and high potential for fast growth and biomass accumulation in all the three tiers, which is very vital for carbon sequestration. Biodiversity index depicts that these forests are experiencing moderate disturbances particularly by fire and grazing as seen by the occurrence of indicator species such as *Colebrookea oppositifolia, Flemingia chapper, Berberis lycium, B. asiatica* and *Randia tetrasperma.*

Village Nishani

The forest of the village is typical moist temperate Oak Forest dominated by *Quercus leucotrichophora, Rhododendron arboreum* and *Myrica esculenta.* Though the young population of *Pinus roxburghii* having the high Important Value Index (IVI), i.e.32.9 (Table 1) indicates that the species has appeared in the later phase of retrogressive succession. This also indicates that in the past these forests have suffered heavy disturbances. However, the occurrence of the seedlings and saplings of oak exhibit an appreciable regenerating pattern forming a mosaic of clusters. This indicates that at present these forests are under protection from biotic interference. As mentioned earlier that the oak requires specific soil and moisture regime for its regeneration in comparison to that of pine. The conspicuous absence of pine in shrub and herbaceous layer represents that the conditions are progressing from xeric to mesic.

Village Forti

The forest of Forti village is also a typical moist temperate forest dominated by *Cedrus deodara* followed by *Pinus roxburghii* and *Ouercus leucotrichophora.* It reveals that

maximus resources are being trapped by *Cedrus deodara* and least by Enocarea *acerifolia*. The presence of *Ouercus leucotrichophora* in shrub layer indicated that the conditions have become favorable for *Ouercus leucotrichophora*, as the system is progressing towards mesic conditions. This is unconformity by the presence of *Berberis aristata* and *Rhododendron arborium* in the shrub layer indicated some disturbances i.e. fire and grazing. Inspite of all the facts these communities are highly potential for Carbon sequestration.

Conclusively it deserves to be noted that all the above mentioned villages with rich diversity are situated between 1500 to 2000 msl. Such situation falls under ecotonal zone creating heterogeneous condition that is favourable for the development of flora and raising plantation. The forests of northern aspects are dominated by broad-leaved deciduous species that sequesters carbon faster than the evergreen species such as *Pinus roxburghii*. To enhance the water yield these forests require protection under present situation, as they are the perpetual source of our perennial rivers.

Table 1: Importance Value Index (IVI) of dominant Species in different Tiers along with Soil Properties

Name of village	Vegetation Type	IVI			Soil Properties	
		Trees	Shrubs	Herbs	Texture	pH
Katarmal	Pine	160.2	69.2	13.5	Sandy	6.6
Aaina	Pine	300.0	109.0	16.4	Sandy	6.7
Kunwali & Pagsa	Pine	300.0	47.8	12.3	Sandy	6.7
Adhuriya	Pine	300.0	93.7	20.5	Loamy	6.5
Nishni	Oak	175.5	75.5	2.7	Loamy	6.4
	Pine	32.9	2.0	-		
Forti	Deodar	103.3	26.8	-	Loam	6.4
	Pine	76.7	11.2	-		
	Oak	63.1	87.4	-		

(ii) Species Diversity

The diversity of tree species in the forest of Forti, Nishani and Katarmal are 1.50, 0 95 and 0.76 respectively though there is not much variation in species richness (Table 2). This indicated that these have reached to stability particularly Nishni and Forti. This can further be confirmed by the presence of high tree density, which needs silvicultural operations. With regard to Aaina, Kunwali and Adhuria forest are dominated by a single species ie. *Pinus roxburghii*. It appears that the soil of these forest cover is highly degraded as indicated by the sandy texture with low moisture holding capacity, except for Adhuria, thus favours *Pinus roxburghii* dominated community.

Table: 2- Species diversity of Trees, Shrubs and Herbs along with Species Richness as sown in parenthesis.

Name of Villages	*Species Diversity*		
	Trees	Shrubs	Herbs
Katarmal	0.76(5)	1.51(7)	1.44(31)
Aaina	0.0(1)	1.37(5)	0 99(19)

Name of Villages	Species Diversity		
Kuwali & Phagsa	0.0(1)	2.09(10)	1.15(27)
Adhuriya, Dayuna & Biralua	0.0(1)	1.64(9)	2.61(22)
Nishani	0.95(5)	1.75(18)	2.33 (70)
Lohaghat	1 50 (7)	2.51(23)	1.78(36)

(iii) Carbon Stock

General:

The net carbon budget of the forest is a fine balance between process of carbon acquisition (photosynthesis tree growth, forest aging, carbon accumulation in soil) and process of carbon release (respiration of living biomass, tree mortality, microbial decomposition of litter, oxidation of soil carbon, degradation and disturbances). However, the carbon stock of an ecosystem is influenced by climatic and environment variables, besides different land use patterns. The carbon stock in vegetation and soil of different study site are described below.

Vegetation:

The carbon stock in vegetation under various sites varies greatly due to different vegetation types. On an average the carbon stored (106.7 t h^{-1}) by temperate forest of Nishani (119.7 t h^{-1}) and Forti is (Table 3) substantially high compared to that of 57.0 t h^{-1} carbon stored by temperate forest biomes of the world (Dixon *et al.,* 1994). This is in conformity that these ecosystems are highly productive because of ecotonal zone followed by heterogenous environment. Similarly the Pine dominated sites stored on an average 171.0 t h^{-1} of Carbon except for Kunwali and Phagsa (66.5 t h^{-1}). The high carbon storage in these pine dominated sites is a reflection of old growth forest compared to Kunwali and Phagsa. The carbon stock (83.8 t h^{-1}) of Civil Soyam Forest of Nishani village indicates that it is a young plantation of *Pinus roxburghii, Acacia measnsii* and *Cupressus torulosa.* However the carbon storage recorded 213 t h^{-1} under such similar forest dominated by Oak and Chir controlled by state forest division is substantially high. Similarly Pine dominated forest of Katarmal stored substantially high carbon (174.4 t h^{-1}) compared to that of Chir pine forest (99.5 t h^{-1}) of similar altitude (Rana *et al.* 1989). This can be substantiated that mixed forest with *Quercus* spp. are highly productive in carbon sequestration

Table 3: Biomass and carbon stock in vegetation (t h^{-1}) under various land uses.

Locality	Tree Species	Average Diameter (cm)	Density (trees ha^{-1})	Biomass (tha^{-1})	Carbon (tha^{-1})	Total carbon (tha^{-1})
Nishani (Forest)	*Quercus leucotrichophora*	19.4	1127	150.7	75.4	**106.7**
	Pinus roxburghii	13.8	140	28.9	14.5	
	Rhododendron arborium	21.7	260	24.7	12.4	
	Myrica nagi	19.7	100	8.6	4.3	
	Pyrus phasia	5.7	7	0.2	0.1	
Nishani (Plantation)	*Pinus roxburghii*	9.9	750	156.2	78.1	**83.8**
	Acacia mearnsii	7.4	125	7.0	3.5	
	Cuprussus torulosa	5.9	100	4.4	2.2	

Locality	Tree Species	Average Diameter (cm)	Density (trees ha^{-1})	Biomass (tha^{-1})	Carbon (tha^{-1})	Total carbon (tha^{-1})
Forti (Forest)	*Cedrus deodara*	22.5	550	100.9	50.5	119.7
	Pinus roxburghii	21.0	330	68.7	34.4	
	Quercus leucotrichophora	8.6	830	49.7	24.9	
	Rhododendron arborium	6.1	180	5.1	2.6	
	Pieris ovalifolia	6.9	110	3.5	1.8	
	Myrica nagi	8.5	281	10.7	5 4	
	Exoecaria acerifolia	3.1	10	0.2	0.1	
Katarmal	*Pinus roxburghii*	36.6	340	331.3	165.6	174.4
	Quercus roxburghii	22.8	150	17.5	8.8	
Kunwali & Phagsa	*Pinus roxburghii*	29.0	285	132.9	66.5	66.5
Aaina	*Pinus roxburghii*	34.7	305	297.2	148.6	148.6
Adhuriya	*Pinus roxburghii*	35.9	390	380.1	190.1	190.1

Soil:

Soil carbon stock (tha^{-1}) under various land use patterns is given in Table 3. On an average forest stores maximum carbon in the soil pool. Most of these study sites falls between 1000m – 1900m. elevation. This indicates that these sites falls under both sub-tropical as well as temperate zone. As per the recorded information from the literature the carbon pool is 123 t ha^{-1} and 96 t ha^{-1} in tropical and temperature forests respectively. The carbon stock in the study sites is low as compared to the pre-recorded information (Dixon *et al.*, 1994). It is evident that most of the soil carbon is being utilised and stored by the vegetation. This further reveals that these zones are ecotonial zones which seems to be quite promising for rapid carbon sequestration, if fast growing, mixed deciduous species are planted.

Table 4: Soil carbon stock (t h^{-1})

Locality	Land Use pattern				
	Forest	Plantation	Agriculture	Permanent Fallow	Kitchen Garden
Nishni	70.8	26.1	56.1	38.6	65.4
Forti	54.5	-	54.5	34.4	92.2
Katarmal	35.0	-	37.1	13.3	-
Adhuriya	62.2	-	68.5	74.4	-
Aaina	81.1	-	14.8	18.8	-
Kunwali & Pagasa	44.2	-	18.8	32.3	-

With regard to the agriculture the carbon pool is high in Nishni, Forti and Adhuriya, compared to the other sites under study. This is attributed to the slow rate of carbon decomposition, the land being in the northern aspect. In contrary to this low amount of carbon pool in Katarmal, Aaina and Kunwali is attributed to southern slopes with fast decomposition rate of carbon. This applicable to permanent fallow land also. The high amount of carbon value in kitchen garden soil reflects that these sites are being regularly

manured. In general carbon pool in all these landuses is low denotes that these site ate highly degraded.

While comparing the carbon storage by vegetation of village forest, it has been observed that these sites store almost double the amount of carbon compared to that of world biome (Table 5). Similarly the carbon stock in Reserve forest is three and half times more than that of world biomes. Thus it can be concluded that forest of Uttaranchal has tremendous potential for carbon sink if proper attention is given through scientific management.

Table 5: Comparative Carbon stock (t h^{-1}) by vegetation.

	Village Forest	Reserve Forest (Rana *et al.* 1989)	World Biomass (Temperate Forest)
Vegetation			
Nishani (Forest)	106.7	213.0	57
Forti (Forest)	119.7		
Nishani (Plantation)	83.8		
Pinus roxburghii dominated forest	144.9		
Soil	58.9	-	96

Singh et. al. 1985 have shown that centre Himalayan forests are the net contributor to global carbon balance. As per their estimates Carbon storage by the poor, medium and good forests ranges between 43.2 - 92.8, 92.8 – 162.4 and 162.4 - 278.6 t/ha and in soils it ranges between 14.3 – 31.0, 31.0 – 53.6, 53.6 – 92.2 t/ha respectively. The values obtained from project sites lie between the poor and medium forest cover. The existing poor and medium forests should be allowed to attain the good status to put back under plantations and management systems to sequester access atmospheric carbon as wood. Therefore, comparison of forest biomass status as referred in the study (Singh et. al. 1985) to that of forests of the project area clearly indicate that these forests are still potential sink of CO_2 and offer great opportunity for further sequestration of CO_2 under a comprehensive management plan.

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CURRENT SOCIO-ECONOMIC STATUS: MALYAL GAD MICROWATERSHED IN ALMORA

Participatory Resource Assessment was conducted from 6th December, 2001 to 14th December, 2001 in villages of the Malyal Gad microwatershed area of Almora district near Ranikhet. Nine Gram Sabha villages were chosen, encompassing a total of 19 revenue villages. This primary data was supplemented with the collection of secondary information from the Forest Department, the Soil Conservation Division, the Block Development Office and the Patwari's office. The findings of the field survey are detailed in the following sections.

Table 1: List of Surveyed Gram Sabhas and the Revenue Villages under them

Aina- Gram Sabha
Pagsa - Gram Sabha
Naugaon (revenue village)
Sutargaon- Gram Sabha
Kaphalna (r.v.)
Nainwalchuk (r.v.)
Mahatgaon - Gram Sabha
Rodpur (r.v.)
Ryunitulla - Gram Sabha
Sunderkhal (r.v.)
Dalmoti (r.v.)
Mallya ryuni (r.v.)
Lavasi (r.v.)
Kuwali – Gram Sabha
Bunga (r.v.)
Dhankholi - Gram Sabha
Dhugaura - Gram Sabha
Batkothi (r.v)
Baguna – Gram Sabha

I. Social Structure of Villages in the Malyal Gad Microwatershed Area:

The total number of households in these Gram Sabhas ranged from as low as 64 in Dhankholi to as high as 400 in Ryunitulla (Table 2). According to household surveys conducted by the Forest Research Institute (FRI), DehraDun, the average family size in this area is about 5-7 members. The major languages spoken are Hindi and Kumauni. The area is dominated by people belonging to the Thakur caste group, followed by the

Table 2: Social Structure Table for Malyal Gad (Ranikhet) Area

Village	# HHs	Population			Major Castes			Literate (%)	
		Males	*Females*	*Total*	*Caste*	*Occupation*	*% HHs*	*Male*	*Female*
Aina- Gram Sabha	167-170	326*	361*	687*	Thakur	Farming, service	48.5	55.83	17.45
					Harijan	Labour	51.5		
Pagsa - Gram Sabha	175	362*	389*	651*	Brahmin	Service, farming	10	54.58*	27*
(2 revenue villages)					Thakur	Service, farming, labour	60		
					Harijan	Tailor,	30		

Village	# HHs	Population			Major Castes			Literate (%)	
		Males	*Females*	*Total*	*Caste*	*Occupation*	*% HHs*	*Male*	*Female*
						labour			
Sutargaon- Gram Sabha	190	217*	316*	533*	Thakur	Farming	80	48*	20*
(3 revenue villages)					Brahmin	Farming	10		
					Harijan	Labour	10		
Mahatgaon - Gram Sabha	130	194*	306*	500*	Thakur	Service, Farming, labour, Army	60	56*	31.7*
(2 revenue villages)					Harijan	same as above	20		
					Brahmin	same as above	20		
Ryunitulla - Gram Sabha	400	2000	3000	5000	Thakur	Farming, service, labour	68.75	73.5*	39.5*
(5 revenue villages)					Harijan	same as above	18.75		
					OBC	same as above	12.5		
Kuwali - Gram Sabha	219*	500	750	1250	Brahmin	Service, Farming, labour, Army	25	53.8*	27*
(2 revenue villages)					Thakur	same as above	25		
					Harijan	same as above	30		
Dhankholi - Gram Sabha	64	128*	133*	261*	Brahmin	Business, farming	80	65.5*	34.6*
(1 revenue village)					Harijan	Farming, labour	20		
Dhugaura - Gram Sabha	236	358	481	839	Brahmin	Farming, service, business	4		
(2 revenue villages)					Thakur	same as above	63.5		
					Harijan	Farming, labour, service	32.5		
Baguna - Gram Sabha	150	426	451	877	Thakur	Farming, service, labour	73.3		
(1 revenue village)					Harijan	Tailor, carpenter, labour	26 7		

* 1991 census data, other figures based on PRA and Forest Department Microplans

Harijans or scheduled caste group and then the Brahmins. The main occupation of the Thakurs is agriculture. All caste groups seem to have similar occupations, namely farming, service and labour (Table1). The villages in this area have similar caste and occupational structures. In most villages, there are a greater number of women than men. The overall ratio is approximately 60:40. The literacy rate of women is much lower than that of men, almost half as much.

Women carry much of the workload, especially among the lower castes. Other than service and small business, they take on all the jobs that men do, including construction and agricultural labour, while also maintaining their households and tending livestock. In all the villages surveyed, it was much easier to find male members of the community who were willing to participate in the PRA than it was to find women. One reason for this was that the women were busy with their daily work and had little or no time to spare. Owing to the poor literacy rate among women, they are often not qualified for higher paying jobs. Women in several villages (Kuwali, Aina, Ryunitulla, Dhankholi, Dhugaura) expressed an interest in learning value-added skills such as sewing or dairy development. Some expressed interest in government jobs. The lack of accessibility to institutions of higher education in this area is a major factor contributing to poor literacy rates among women. Female children are sent to the local primary schools but in many of the villages surveyed, they have to travel further and further from their villages in order to attend high school and inter college.

Alcoholism and unemployment, primarily among men, pose big social problems in this area. These issues contribute to the problems faced by the women in these communities, as very often, they have to play the role of the breadwinner too. Despite the pivotal part that women play in the social and economic structure of this area, very few of them have assumed positions of political significance. Only one of the Gram Sabhas visited in this area, Dhugaura had a woman Pradhan.

II. Infrastructure of Villages in the Malyal Gad Microwatershed Area:

Most of the Gram Sabhas surveyed, with the exception of Sutargaon and Dhugaura, are easily accessible from the umetalled motor road that runs between Majhkhali and Bhagvali pokar. The details of the institutional infrastructure and distances from each Gram Sabha are described in Table 3. Kuwali and Ryunitulla appeared to be the most developed Gram Sabhas in terms of amenities. The proximity of Ryunitulla to Majhkhali (which has a relatively well developed commercial centre) has enabled the development of basic infrastructural facilities such as electricity, telephones and livestock care facilities.

In the other Gram Sabhas, on average 60-70% of the households do not have electricity. Telephones are typically present in only 2-3 of the richer households in the village. Some villages like Dhankholi have no telephone facilities at all. Aina has 2-3 gobar gas plants. There is a veterinary hospital in Majhkhali and Chaukoni. The average distance to these hospitals from most of the villages surveyed is 12km. There is at least one primary school in each Gram Sabha. People in several villages voiced complaints about the lack of qualified teachers and the quality of the education available in these schools. A high school has been established in Kuwali and is attended by children from Pagsa and Mahatgaon Gram Sabhas.

Table 3: Infrastructure Table for the Malyal Gad Microwatershed Area

Village	*Aina - Gram Sabha*	*Pagsa - Gram Sabha*	*Sutargaon- Gram Sabha*	*Mahatgaon - Gram Sabha*	*Ryunitulla - Gram Sabha*	*Kuwali - Gram Sabha*
Approach Rd	Majhkhali-Bagvali road	Majhkhali-Bagvali road	Kuwali-Sutargaon path	Majkhali-Bagvali rd	Majhkhali-Ryunitulla path	Majkhali-Bagvali rd
Status	Unmetalled (branch)	Unmetalled (branch)	pedestrian path	Unmetalled (branch)	pedestrian path	Unmetalled (branch)
Length (km)	5km from Kurudyeen	1km from Kuwali	1km	8km from Kurudyeen	1km from Majkhali	6km from Kurudyeen
Facilities						
District HQ	Almora (40km)	Almora (50km)	Almora (40km)	Almora (50km)	Almora (32km)	Almora (50km)
Block HQ	Dwarahat (32km)	Dwarahat (33km)	Dwarahat (15km)	Dwarahat (30km)	Dwarahat (35km)	Dwarahat (33km)
Panchayat Bhavan	None	none	in village	none	Majkhali (1km)	in village
Forest RO	Someshwar (22km)	Someshwar (50 km)	Ranikhet (25km)	Someshwar (50km)	Ranikhet (11km)	Someshwar (50km)
Forest DO	Almora (40km)	Almora (50km)	Almora (40km)	Almora (50km)	Almora (32km)	Almora (50km)
Horticulture Dept	Majhkhali (10km)	Majkhali (12km)	Majhkhali (14km)	Majhkhali (13km)	Majkhali (1km)	Majkali (12km)
Post Office	in the village	Kuwali (1km)	Kuwali (1km)	Adgal (1km)	Majkhali (1km)	in village
Nearest Main road		Korichina (8km)	Korichina (9km)		Majkhali (1km)	Korichina (8km)
Vet Hospital	Kuwali (2km)	Majhkhali (12km)	Kuwali (1km)	Majhkhali (13km)	Majkhali (1km)	Majkhali (12km)
Other	2-3 Gobar gas plants	Stockman (Kuwali)	Stockman (Kuwali)	Stockman (Kuwali)	High school (1.5km) Govt. Hospital (2km)	Stockman (in village)
Schools	2 Primary schools	Primary & high school (Kuwali)	Primary school	Primary & high school	Primary school	Primary & High school
Electricity	80% HH without	70-75% HH without	50% HH without	60% HH without	10% HH without	75% HH without
Development Schemes	Bal Poshahar	Bal Poshahar	Bal Poshahar	Bal Poshahar	Silayi Kendra	Bal Poshahar
Sponsoring Agency	Central Government	Central Government	Central Government	Central Government		Central Government
Year	Ongoing	ongoing	Ongoing	ongoing	ongoing	ongoing
Activities	Provides 3kg of rice per month to children between 3-9 yrs. (through schools)	provides 3kg of rice per month to children between 3-9 yrs. (through schools)	provides 3kg of rice per month to children between 3-9 yrs. (through schools)	provides 3kg of rice per month to children between 3-9 yrs. (through schools)	teaching women to sow clothing.	provides 3kg of rice per month to children between 3-9 yrs. (through schools)
Status	Inconsistently implemented	inconsistently implemented	Inconsistently implemented	inconsistently implemented	successful	inconsistently implemented
Development Sch.	JFM	JFM	Indra Avash	JFM	Barani	JFM
Sponsoring Agency	Forest Department	Forest Department	Block Department	Forest Department	Horticulture Dept.	Forest Department
Year	1999-2005				1998	2000-2006
Activities	Held workshop, built consensus, set up nursery, plantation of fodder and fuel	held workshop, built consensus, set up nursery, plantation of fodder and fuel	Conducted for Harijan and poor people, provided Rs.22,000 free of cost &loans for cattle. Rs.	held workshop, built consensus, set up nursery, plantation of fodder and fuel	Built checkdams, planted trees	held workshop, built consensus, set up nursery, plantation of fodder and

Village	Aina - Gram Sabha	Pagsa - Gram Sabha	Sutargaon- Gram Sabha	Mahatgaon - Gram Sabha	Kyunulla - Gram Sabha	Kuwali - Gram Sabha
	trees, fire control, check dams, repair of field boundaries, installation of border posts. **	trees, fire control, check dams, repair of field boundaries, installation of border posts **	10,000 for repairs	trees, fire control, check dams, repair of field boundaries, installation of border posts. **		fuel trees, fire control, check dams, repair of field boundaries, installation of border posts. **
Status	Successful	Successful		Successful	Unsuccessful	Successful
Development Sch.	Swajal Yojana		JRY,SRY*	J R Y *	Kalleen Bunayi Kendra	JRY,SRY*
Sponsoring Agency	World Bank		Block Department	Block Department		Block Department
Year	1962 - present				1990's	
Activities	Drinking water provision, built two tanks, tested water				carpet weaving	
Status	Successful				inactive	
Village	*Dhankholi - Gram Sabha*	*Dhugaura - Gram Sabha*	*Baguna - Gram Sabha*			
Approach Rd	Majhkhali-Bagvali road	Chanagolu-Dhugaura	Majhkhali-Bagvali road			
Status	Unmetalled (branch)	pedestrian path	Unmetalled (branch)			
Length (km)	15-20 km	1.5km	16 km from Bagvalipokar			
Infrastructure Facilities						
District HQ	Almora (~40km)	Almora (45km)	Almora (60km)			
Block HQ	Dwarahat (30-35km)	Tarikhet (45km)	Tarikhet (100km)			
Panchayat Bhavan	in village	none	none			
Forest RO	Ranikhet (~20km)	Someshwar (>50km)	Someshwar (50km)			
Forest DO	Almora (~40km)	Almora (45km)	Someshwar (50km)			
Horticulture Dept	Majhkhali (~6km)	Chillianola (42km)	none			
Post Office	Aina (~4km)	Mahatgaon (3km)	Radgal (2km)			
Nearest Main road	Majhkhali (~6km)	Korichina (3-4km)	Korichina (3-4km)			
Vet Hospital	Majkhali (~6km)	Chaukoni (15km)	Chaukoni (15km)			
Other						
Schools	Primary school	Primary school	Primary school			
Electricity	~20% HH without	only in revenue villages (not in hamlets)	~75% HH without			
Development Schemes	Swajal Yojana	Swajal Yojana				

Village	*Aina - Gram Sabha*	*Pagsa - Gram Sabha*	*Sutargaon- Gram Sabha*	*Mahatgaon - Gram Sabha*	*Ryunitulla - Gram Sabha*	*Kuwali - Gram Sabha*
Sponsoring Agency	World Bank	World Bank				
Year	1998 -99	1998-2001				
Activities	2 hand pumps and 9 stand posts with taps installed throughout the village, toilets created, planting of trees.	Implemented by Vadhu Sanstha: pipes installed, ecodevelopment, latrines, wastedumps, wash basins.				
Status	Successful	Partially successful, due to high costs, some families have been unable to maintain the scheme				
Development Schemes		JFM				
Sponsoring Agency		Forest Department & World Bank				
Year		1999 - 2005				
Activities		Establishment of nursery, planting of mainly Chir, Oak &Tun. Proposed activities: fire control, check dams, boundary maintainence.				
Status		So far unsuccessful due to poor implementation, drought and lack of protection.				

* J.R.Y. - Jawahar Rojgar Yojana. S R Y. - Swarjanty Yojgar Yojana
** Some of these activities have yet to be implemented under JFM.
In addition Sutargaon- soil conservation Division works in the Van Panchayat

Kuwali - Angan Bari, Ag Dept provides seeds @ nominal cost, FD also provides trees at nominal cost.

There are a number of development schemes being implemented in the area we surveyed, namely the Joint Forest Management scheme and the Swajal Yojana. The Joint Forest Management Programme is being implemented in five of the nine Gram Sabhas surveyed. This scheme was started under the Indian Forest Act of 1988, which put in place this mechanism in order to increase and encourage the participation of local people in the management of their forest resources. JFM has been undertaken in these areas by the Forest Department in cooperation with the Van Panchayats in their respective villages. The Forest Department has prepared microplans for each of the concerned villages. These formed a valuable source of secondary information for our study. Some of the activities undertaken by JFM programmes include; holding workshops with local people, consensus building, setting up nurseries, planting fodder and fuelwood trees, conducting training programmes, building check dams and repairing and maintaining field boundaries. The JFM schemes underway in this area have met with mixed success so far. In most cases failure is due to poor implementation, distrust between the Forest Department and local communities, lack of protection measures and a lack of rainfall. Another major development scheme being implemented in this area is called the Swajal Yojana. Funded by the World Bank and implemented by various local village and NGO agencies, its main mission is to make drinking water easily accessible to local people. Under this scheme, hand pumps, pipes, stand posts and latrines have been installed in several places within the selected villages. This programme has been implemented in a participatory manner and has been quite successful in the areas in which it has been implemented so far. Other development schemes in place in this area include Block Development schemes such as the Jawahar Rojgar Yojana (JRY) and the Swarjanty Rojgar Yojana (SRY) which provide employment to local people. Minor projects such as a sowing center and a carpet weaving center were also undertaken in the Majhkhali-Ryunitulla area.

III. Resources and Patterns of Usage in the Villages of the Malyal Gad Microwatershed Area:

There is a large amount of variation in the total areas of the Gram Sabhas surveyed, which does not seem to be correlated with the number of revenue villages under a Gram Sabha. Aina, which has only one revenue village has as much as 403.86 ha of land (Table 4), while Sutargaon, which has three revenue villages under it, has a total combined area of 193.5 ha. Dhugaura, with two revenue villages under it encompasses a total of 393.72 ha. The average total area of these Gram Sabhas is 281.46 ha.

Agriculture

On average about 55% of the total area under these Gram Sabhas is cultivated. Kuwali Gram Sabha has the highest proportion of land under agriculture. Other than in Aina, an insignificant amount of this cultivated land is irrigated (Table 4). Where present, irrigation techniques range from canals to guls (such as in the case of Dughaura). Agriculture is primarily rainfed in these areas. Dhankholi Gram Sabha has the lowest proportion of agricultural land (28%) of all the areas surveyed. A typical crop cycle for this area is displayed in Appendix G8. If there is adequate rainfall, there are two crops sown in a year, Kharif and Rabi. The Kharif crop is sown between May and June and harvested in September-October. The Rabi crop is sown in October-November and harvested in April - May. The main Kharif crops grown in this area are paddy, madua, urad dal, kala bhat, potato, onion, methi, spinach and soya bean. The main Rabi crops are wheat, musoor, channa and

mustard. Vegetables like turiya, cucumber, lauki, capsicum are grown mostly during the rainy season. Most of the sowing is done by hand. The primary source of fertilizer in this region is manure. Urea is used to a lesser extent and only for specific crops. Field repair and maintenance takes place during February and March. Apart from cultivation of crops in fields, several households have a small vegetable garden where they grow enough to meet their domestic needs. Fruit trees like lemon, malta, pomergranate and pear are also common around houses in this area.

Forests

The forests in this area are almost exclusively constituted by Chir pine. There is very little structural diversity within the forest stands as well. The Reserved Forests appear to be of much higher quality than the Van Panchayat and Civil Soyam forests. There is some variation in the degree of degradation of forest areas between villages. The Van Panchayat lands under Dhugaura seemed to be under good, dense forest cover, whereas those of Dhankholi and Aina appeared to be more degraded.

Table 4: Resource Table for the Malyal Gad Microwatershed Gram Sabhas Surveyed

Village	Total Area	Habited Area	Pasture Land	Agricultural land						Forest Land			
	(ha)	(ha)	(ha)	Irrigated (ha)	Unirrigated (ha)	Current Fallow (ha)	Culturable waste (ha)	Unculturable waste (ha)	Total cultivated (ha)	Revenue Department			Forest Department (ha)
										Civil/Soyam	Van Panchayat	Total (ha)	
Aina- Gram Sabha	403.86			25	100		266.66	12	125	115.596*	124.18"	239.776	present
Pagsa – Gram Sabha	128.76	40 (approx)^		0.996	61.854		4.454	0.83	63 9		60 7"	60 7	absent
Naugaon (revenue village)	167	included above		included above	included above		included above	included above	76 5		6"	6	absent
Sutargaon- Gram Sabha	136.96			-----	45.96		25.601	0.12	45 96	45 (in the whole G S)*	46"	91	absent
Kaphalna (r.v.)	21.182			0.536	14 6		5.264	1.064	14.6		4.1"		absent
Nainwalchuk (r.v.)	35.38			-----	26.16		14.852	0.49	26.16				absent
Mahatgaon - Gram Sabha	156.5	2.5^		5.745	36 515		47 767	0.951	58.9	86.2*	8.9"	0	
Rodpur (r.v.)	62.47			6.716	13.664		19.336	11.082	21.36	included above	25.29"	25.29	
Ryunitulla - Gram Sabha	267 86			-----	125 5				125.5	4^	2.525"	6 525	absent
(5 revenue villages)													
Kuwali - Gram Sabha	456.95			84*	163*		12.82	1.051	247*	187*	47.35"	0	absent
Bunga (r.v.)	24.4			included above	included above		1.372	3.094	included above	included above	nil"		absent
Dhankholi - Gram Sabha	133.58	100 (acres)		nil	35		35.01	3	37.5	nil^	57.87"	57.87	present
Dhugaura - Gram Sabha	393.72	50^	nil^	20*	112.62*	10^	insignificant^	mostly converted to forest^	132.62*	30*	70.83*	100 83	absent

(2 revenue villages)													
Baguna - Gram Sabha	169.5			-----	85.5*			84*	85.5*	67*	17*	0	absent
(1 revenue village)													

' data from Van Panchayat Inspector , *from Forest Dept., ^ data from PRA, rest from Patwari's office.

On average about 41% of the total land in the Gram Sabhas surveyed is under some sort of forest cover. Mahatgaon Gram Sabha has the highest proportion of forest cover (91%). Most of this forest cover is classified as Civil/Soyam land. Ryunitulla village has the least forest cover at 0.02%. Reserved forests are present in Aina and Dhankholi. According to our data, Pagsa and Dhankholi are the only Gram Sabhas without civil/soyam forests. In all nine Gram Sabhas, the dependence on forest resources is high for fodder, fuelwood, construction and grazing. Most of the villages do not have permanent pasture lands and the people practice free grazing in forest areas. The main source of fuelwood in these areas is Chir pine branches. Other species used for fuelwood are Oak, Mehal, Kharik and Timul. Fuelwood is required year-round, though demand peaks during the winter months. According to the FRI household survey in Pagsa, the average amount of fuelwood used in 21 houses was 298.8 kg/month, of which an average of 230 kg was used for cooking per month. In Kuwali, the four households surveyed used an average of 350 kg/month for cooking. Most of the collection is done over the winter months. The species used as fodder include; grasses, Oak, Falyat, Kharik, Bhimal and Bitan. The FRI survey revealed that an average of 513kg of grasses per month was being fed to cows in Pagsa and about 300kg/month was being used in Kuwali households. Buffaloes consumed a higher amount of 582kg/month in Pagsa. The Forest Department has estimated the total fuelwood, fodder and grazing demand in two of the surveyed Gram Sabhas. This information has been tabulated below (Table 5):

Table 5: Data from Forest Department on demand for forest products in two of the surveyed Gram Sabhas

Village	Forest Resource Item	Estimated Demand (tonnes/year)	Estimated Supply (tonnes/year)	Deficit (tonnes/year)
Baguna	Fuelwood	515	380	135
(1 r.v.)	Fodder	940	760	180
	Grazing (grasses)	260	170	90
	Small timber	1.5	0.7	0.8
	NTFP Collection:			
	Fruits	120	60	60
Sutargaon	Fuelwood	285	206	79
(3 r.v.)	Fodder	951	763	188
	Grazing (grasses)	238	166	72
	Small timber	1.4	1	0.4
	NTFP Collection:			
	Fruits	116.26	69.86	46.4

In addition to this biotic pressure, there is also a dearth of seedbearing trees and hence the recruitment in these forests is inadequate. Another reason for the poor quality of the forests in this area is that there is a lack of cooperation between the Forest Department and local villagers. In some cases there has also been a lack of consensus between Van Panchayat members and villagers, which has led to neglect and inadequate protection of forest resources.

There is very little extraction of non-wood forest products in this region. The main product is wild fruits. While medicinal trees and plants such as Kaphal, Semal, Reetha, Hisaloo, Rambans, Peppermint and Kilmaru occur in the forests of this area, they are not harvested for sale. In many villages, such as Dhugaura, Bunga and Ryunitulla, people said that they lacked the knowledge and skills to identify, extract and process medicinal plants. The medicinal plants of this area are therefore an untapped resource with great potential.

Agroforestry & Horticulture

Despite the shortfall in the supply of fodder and fuelwood from the forests, villagers in this area have not undertaken agroforestry in any organized way. Joint Forest Management projects (described in Section II) have been undertaken with local Van Panchayats and the Forest Department with mixed success. About 60 different species are to be planted in the area under these schemes, including fuelwood, fodder and fruit trees. However, no organized effort has been made to plant such trees on private agricultural land. The main reason for this is the lack of irrigation facilities. Another constraint faced in this area is the fact that fields are scattered and people find it difficult to protect them from livestock and monkeys. There is also a fear of crop loss due to shading from trees growing along field margins. In most Gram Sabhas, certain fodder and fuelwood species (Oak, Bhimal, Kharik, etc.) occur naturally on field margins. These trees are used extensively in times of shortage and where the supply from the forests is highly inadequate. All the people interviewed during the PRA expressed interest in an agroforestry scheme, provided their irrigation problems were taken care of. They voiced a preference for both fodder and fuelwood trees such as Bhimal, Oak, Kharik, Bakain and Tun. The people in Dhugaura, where the irrigation facilities are well developed, would prefer to grow fruit trees. The best species would be those that can be used for multiple purposes such as Bamboo, Oak, Bhimal and Bakain. There was a universal need for all kinds of information regarding agroforestry including; technical, species related, land related, nursery techniques, market related and permit related information. Most people preferred Goshti and Panchayat meetings as the medium of information dissemination. The preferred information dissemination agency varied from village to village. Baguna, Dhugaura and Aina preferred the Block Development Office (BDO) as the main source of information on agroforestry, while people in Kuwali, Mahatgaon, Sutargaon and Pagsa preferred the Forest Department. The people of Dhankholi wanted information through a non-governmental organization and those of Ryunitulla the Agricultural Department and the BDO.

Horticulture is practiced on a very small scale in these areas. Fruit trees are grown mainly around homesteads for domestic consumption. Species include Lemon, Malta, Mango, Pear, Papaya, Grapes, Banana and Akrot. In Aina, Pagsa and Ryunitulla, Mango, Gola and Akrot is marketed on a small scale. People in Kuwali, Bunga, Dhugaura and Ryunitulla expressed interest in commercial horticulture and production of value-added fruit products such as jams and pickles. The growth of citrus fruit trees in this area is especially good and provides a potential source of supplemental income. Access to markets is an important factor in the development of horticulture in this area. Residents of both Mahatgaon and Dhugaura expressed a preference for horticultural development over agroforestry development or forest regeneration programmes. They felt that enough had been done to develop the forest areas and more needed to be done in terms of agricultural and horticultural development. Village residents in all the areas visited cautioned that horticulture would not be successful in this region on a commercial scale until there was adequate water supply to the fields.

Soil

Sandy soil and a mixture of clay and sand is the most common soil type in this area. The other types of soil present are Domat and rocky soil. In Sutargaon, clay soil is the most common and in Dhugaura, which is part hillock and part valley, Domat soil is the most common. Dhankholi has mostly rocky soil (80% according to our PRA). Sandy, clay and rocky soil are primarily used for agriculture and habitation. Most areas with rocky soil are still under forest cover.

Water

While natural sources of water are relatively plentiful in this area, access to water from hillside and hilltop villages is a problem. The main sources of potable water are natural springs. There are covered springs in most villages called *naulas*. However the natural springs that flow in adjacent forested areas are preferred sources of potable water, as the water is purer. The Swajal Yojana, funded by the World Bank has been successful in bringing drinking water and latrine facilities to the people of Dhankholi, Aina and Dhugaura (Table 2). In the villages that do not have hand pumps and stand posts installed near houses through schemes like the Swajal Yojana, the average distance travelled to fetch drinking water is 1-2km. In Ryunitulla it is as much as 4km. The average time spent fetching water is 2.5 hrs per day. In some of the villages (Sutargaon, Kuwali, Ryunitulla) there is a shortage of water in the summer months (May-June). With the exception of Sutargaon, the quality of the potable water is generally good, as most of it is spring-fed.

IV. Livelihood & Economy of Villages in the Malyal Gad Microwatershed Area:

> *"It hasn't rained here and the crops have failed. How can it rain when there are bombs falling from the sky in Afghanistan?"* – Aina resident making light of the economic hardship currently facing the entire region.

The paradox of this region is captured in the statements of one of the residents of Aina. People who are exposed to the very latest in technology and information, living in these relatively remote hillside villages where water is not a scarce resource, still face a crippling dependence on rainfed agriculture and (in some areas) have to walk kilometers to fetch drinking water. Access to water for irrigation and domestic use remains one of the biggest limiting factors in raising the living standards of local people.

Agriculture & Livestock:

As discussed in the previous section, agriculture is the mainstay of the village economies in this region. There are two crops grown a year and vegetables are grown during the rainy season. The main cereals produced are wheat, rice, corn and madua. The FRI household survey in Kuwali and Pagsa revealed that the average production of these cereals per household was 4 bags, 6.3 bags, 1.3 bags and 3.7 bags. The main pulses grown in this area are soyabean, urad, gaut and rajma. The average production of these pulses per household in Pagsa was found to be 20kg, 13kg, 11.5 kg and 10 kg respectively.

Apart from agriculture, livestock provides a supplemental source of income, primarily through the sale of milk. The average milk output per cow is one litre and per buffalo it is 1-2 litres. Aina and Ryunitulla were the biggest sellers of milk of the Gram Sabhas surveyed. There are however no significant livestock improvement, dairy development or fodder production schemes in place in this region.

The main livestock animals in this area are cows, buffaloes, goats and bulls. Poultry is bred to a limited extent, mainly by the lower caste households (Table 6). The FRI household survey in Pagsa found that, on average, there were about 7 animals per household. Livestock are fed grass that grows in the area, agricultural residue and leaves from trees like Bhimal and Bakain. Improved fodder such as Chaukhad and Khal are not used except in the case of Ryunitulla. The residents of this Gram Sabha purchase fodder from the market in Majhkhali. The amount of milk obtained from cows and buffaloes is insufficient and of a poorer quality owing to the lack of proper fodder and proper breeding. The residents of the Gram Sabhas surveyed lack adequate knowledge and awareness of better breeding and fodder production techniques. Artificial insemination is practiced in Sutargaon, Mahatgaon and Kuwali with about a 50% success rate. The production of milk can be increased by implementing breed improvement programmes. Such programmes would not only provide sufficient milk for domestic consumption, but also create enough to sell so that the people could supplement their income as well.

Table 6: Composition of Livestock Holding in Malval Gad Gram Sabha

Gram Sabha	***Cows***		***Bulls***		***Goats***		***Buffaloes***		***Other***	
	Total*	Avg. #/family*	Total*	Avg. #/family*	Total*	Avg. #/family *	Total *	Avg. #/family *	Total*	Avg. #/family*
Aina	227		140		126		101		31	
Pagsa	244		21		164		76			
Sutargaon	380-570	2-3	190-380	1-2	50-75	2-3	40	0-1		
Mahatgaon	100		200		100		20			
Ryunitulla		2-4				2-3		2	Poultry	1-2
Kuwali	225	2-3	145	1-2	94	2-3	84	0-1	8-10	
Dhankholi	100	2-3			50-60	1-2			Poultry	
Dhugaura	244	1-2	218	0-1	164-200	1-2	50-76	0-1	15-20	
Baguna	105	3-4			150-156	1-2	39-50	0-1		

* These data have been compiled from PRA and Forest Department Microplans

The forests, fields and trees that naturally occur along the field margins meet the demand for fodder. Women are primarily responsible for fodder collection and cattle grazing. Free grazing is commonly practiced in forest areas. There is a greater dependence on forests as a fodder source. According to an FRI household survey, the average distance travelled to gather fodder in day varies from one village to another. In Pagsa it was 3.7km whereas in Kuwali it was 1km. On average in Kuwali and Pagsa about 3-5 hrs a day were spent in the collection of fodder. The survey also revealed that an average of 513 kg of grasses per month was being fed to cows in Pagsa and about 300 kg/month was being used in Kuwali households. Buffaloes consumed a higher amount of 582 kg/month in Pagsa. The main fodder used is grasses and agricultural waste, supplemented by green leaf fodder. The following table ranks each species of fodder tree by preference. This information was compiled by the Forest Department in consultation with the villagers in Dhugaura.

Table 6: Ranking of Tree Species by Preference as Fodder for Livestock

Species	Availability	Animals' Preference	Beneficial for milk Production	Ease with which it can be gathered	Total	Rank
Bhanj (Oak)	9	6	5	6	26	III
Falyat	4	5	4	2	15	IV
Bhimal	7	9	9	9	34	I

Bitan	8	7	7	6	28	II
Kharik	5	6	2	2	15	IV

Data collected by Forest Department in consultation with village residents

Table 7: Seasonal Table of Stall Feeding of Livestock as Described in the Forest Department Microplans

Animal	Total stall fed amount (kg)	After grazing in the forest (kg)	Amount grazed in forest (kg)
Rainy season			
Cow/bull	15	5	10
Buffalo	25	25	0
Goat	5	0	5
Summer			
Cow/bull	7.5	5	2.5
Buffalo	15	15	0
Goat	5	0	5
Winter			
Cow/bull	7.5	5	2.5
Buffalo	25	25	0
Goat	5	0	5

The main diseases in this area are Khurpakka in which the legs of the animals (mainly cows and buffaloes) get infected with an insect which causes a fever, stomach upset and distended tongue. Another common disease is Kiriya or Galladhoi which is very similar to tuberculosis. The nearest vet hospitals are in Ranikhet and in Majhkhali which are 24 and 8 km away respectively. There is also a stockman present in Kuwali who provides care for minor livestock ailments.

There is a great need for proper training and an increased knowledge of scientific techniques in livestock management in this area.

Division of Labour:

Men's Role:

The men in the Gram Sabhas surveyed participate in agricultural work, including ploughing, field maintenance, sowing and harvesting. They also work as labourers on construction sites and agricultural fields. They help with the collection of fuelwood and timber for construction. Some of the educated men in these areas hold service sector jobs, some run small businesses, while others have left to join the army. Many young men have migrated out of their native villages in search of higher paying jobs in towns and cities.

Women's Role:

Women play a very important role in the economy and daily life of this area. Apart from running households and raising children, they also participate in agricultural activities during sowing and harvest and they tend livestock. Women from lower castes often earn a living as labourers on construction sites. Most of November – February is spent collecting

fuelwood and fodder, after that, women are busy with agricultural work. They usually collect 25-30 kg of fuelwood per day during winter and store it for use over the rest of the year. They travel a distance of 1-7 km to gather wood or fodder. Much of their day is spent in the collection of fodder and fuelwood and, in some cases, fetching water. Figure 1 displays the typical seasonal, daily work schedule of women in the villages surveyed.

Figure 1: Seasonal Time Schedule of Women

Season	Dawn to 9 A.M.	9A.M. to 12A.M.	12A.M. to 4 P.M.	4P.M. onwards
Winter	* Milking of cattle and cleaning their sheds * Cooking food and preparing children for school * Collection of water	(i) Go to the jungle for fodder collection (ii) Repairing of fields, transporting cow dung to the fields	1. Sowing wheat, jowar, mustard seed, potatoes and weeding 2. Feeding cattle fodder and water 3. Household chore 4. Collection of fuel wood	1. Milking cattle 2. Collection of water 3. Feeding family 4. Household chore and then sleep at 9 P.M.-
Summer	1. Get up at 5:30 2. Milking of cattle, feeding them fodder and water and cleaning sheds of livestock 3. Collection of water 4. Cooking food and preparing children for school 5. Collection fuelwood and fodder from homesteads	1. Harvesting and threshing jowar, mustard seeds 2. Levelling field after ploughing by men and application of cow dung in the field	1. Household chore and preparing food 2. Feeding cattle fodder and water	1. Sowing of paddy, bhat, ghat, madwa 2. Digging out potato tubers 3. Collection of water 4 Livestock related work 5. Cooking food and feeding family 6. Sleep at 11P.M.
Monsoon	1. Get up at 6 A.M. 2. Milking cattle, feeding them fodder and water and cleaning sheds of livestock 3. Cooking food and preparing children for school 4. Go to jungle for collection of grass	1. Weeding agricultural lands from the fields 2. Harvesting paddy	1. Cooking food, household chore 2. Feeding cattle fodder and water	1. Field related work and collection grass 2. Feeding cattle fodder and water 3 Cooking food and looking after kids 4. Household chore 5. Sleep at 10 P.M.

Landholding Size and Distribution:

There were no households with 10 acres or more of land in any of the Gram Sabhas surveyed. The average land holding size is about 0.5 – 1 acre. According to the FRI household survey, in Kuwali the average land holding size was 0.53 acres and in Pagsa it was 0.92 acres.

Table 8: Landholding Data by Gram Sabha, Gathered Through PRA Survey

Holding size	*Aina - Gram Sabha*	*Pagsa - Gram Sabha*	*Sutargaon- Gram Sabha*	*Mahatgaon - Gram Sabha*	*Kuwali - Gram Sabha*	*Dhugaura – Gram Sabha*
> 10 acres	nil	nil	nil	nil	nil	nil
5 - 7.5acres	21.1	2	nil	nil	nil	4
2.5 – 5 acres		10.3	1	8.6	nil	4
1-2.5 acres		36.2	11	38.7	nil	11

0.7 – 1acre				34	7.8	
0.5 – 0.7 acre	78.9	51.5	88		19.2	74
0.2 – 0.5 acre				17	19.2	
< 0.2 acre				1.7	53.8	
Landless	nil	nil	nil	nil	nil	7

According to the PRA conducted, Dhugaura and Aina had families with as much as 5-10 acres of land (Table 8). Most people own fields less than one acre. There is not much disparity between landholders, except for a select few who own more land than others. Eventhough the land holdings in these areas are small, land-less households are rare. In Mahatgaon 1.7% of the households own less than 0.2 acres, 17% own 0.2-0.5 acres, 34% own 0.5-1.42 acres, 38.5% own 1.42-1.98 acres and 8.5% own 2.47 acres. In Aina, 3.5% of the households own 7.41 acres of land, 17.6% own 2.47 to 7.41 acres, 78.8% own less than 2.47 acres. In Pagsa Gram Sabha, 1% of the households own between 5-10 acres, 10% own 2.5-5 acres, 36% own 1-2.5 acres and 51% own less than one acre. Kuwali Gram Sabha has 7.7% households with 0.7 acres, 19.2% with 0.5-0.7acres, 19.2% with 0.2 to 0.5 acres and 53.8% with 0.2 acres or less.

Income Groups, Structure and Composition

The average monthly expenditure for 21 families in Pagsa, according to the FRI household survey, is about Rs. 2,619 and in Kuwali it is Rs. 1,875, for the four households surveyed. The main source of income in this area is from agriculture, although some people have small businesses or jobs in the service sector. In Mahatgaon, 30% of the families draw their income from the service sector. Table 9 summarizes the economic structure of some of the Gram Sabhas surveyed. The definition of the income groups in the following table is: the very poor class includes all people who constantly have to remain in debt to make ends meet, the poor class includes those who have to take on debt for specific reasons e.g. marriage, etc., the middle income group includes those who can meet their expenses throughout the year without taking on any debt and the higher income group includes those who economic condition is considerably better than the middle income families.

Table 9: Summary of Economic Structure in Five Gram Sabhas

	(%) Households				
Income Group	*Aina - Gram Sabha*	*Pagsa - Gram Sabha*	*Mahatgaon - Gram Sabha*	*Kuwali - Gram Sabha*	*Dhugaura - Gram Sabha*
very poor	58.7	42.7	26.9	27.4	50.5
poor	8.9	40.5	38.5	39	
middle	27.6	16.8	34.6	33.6	35.6
higher	4.8	nil	nil	Nil	13.9

This data was compiled from Forest Department Microplans

In Aina, 83% of the very poor class is constituted by Harijans. In other places, the very poor families come from both high and low castes in about equal proportions. In Aina, Mahatgaon and Kuwali the poor class is made up mostly of higher caste families. The middle income class is almost exclusively constituted by higher caste families and the higher income class is exclusively higher caste families. Proportionally by caste, most Harijan families (60-90%) belong to the very poor income group, about 30% belong to the poor group and less than 1% belong to the middle income group. In comparison, among the higher caste families, most belong to the middle income group (40-53%), some belong

to the poor class (16-40%) and a few belong to the very poor class (17-20%). A small proportion of the higher caste families belong to higher income groups (10-13%) in Aina and Dhugaura.

V. Constraints to Development in the Malyal Gad Microwatershed Area:

As stated in preceding sections, the major constraints to development in the Malyal Gad microwatershed area are lack of access to water, women's socio-economic status and the problem of alcoholism. The water issue can be addressed by working with organization that are already involved in bringing potable water to this area such as the Swajal Yojana. No major irrigation schemes were encountered during our field survey. Existing methods of small-scale irrigation such as canals and guls can be improved and introduced into areas where they provide a suitable solution to the irrigation problem. This might be done as part of a larger watershed development project. The residents of all the Gram Sabhas visited expressed deep concern regarding this issue and their willingness to participate, monetarily and through volunteerism, in a holistic watershed development programme.

Several women participants in the PRA voiced interest in schemes that would help them develop small cottage industries such as sowing, weaving, jam making etc. They are eager to learn new skills that would help them increase their income and thereby their influence within the community. Enabling the women of these Gram Sabhas to organize themselves in ways that would further their own interests would benefit the community at large and contribute towards the sustainable use of resources. Improving the literacy rate among women is a necessary step towards this end.

The issue of alcoholism in the area should be dealt with in order to improve the economic and social health of families in this area. Heeradevi, the Pradhan of Dhugaura has set a bold example by forcing the closure of liquor shops in her Gram Sabha. This shows that alcoholism can be dealt with politically in this area. It should also be dealt with in terms of its social and psychological impacts, through the establishment of counselling and rehabilitation centres.

These constraints and ways to overcome them should be taken into account while designing a successful, sustainable watershed development programme in this area.

CURRENT SOCIO-ECONOMIC STATUS: KOSI SUB-WATERSHED IN ALMORA

Introduction

A cluster of villages was selected in the Kosi catchment area, and PRA was conducted from the 11th of December to the 13th of December. PRA was conducted in the Gram Sabha's and information was recorded for all the Revenue villages under that Gram Sabha. Six Gram Sabha's were covered in this cluster. They are as follows:-

Table 1: List of the cluster of villages in Kosi catchment

SL. No.	Gram Sabha	Villages
1.	Dhari	Dhari
		Jolswar
		Latwalgaon
		Tani
		Sanachad
2.	Chan	Chan
		Naugaon
3.	Jyoli	Jyoli
		Kharkuna
4.	Kaneli	Kaneli
		Bisra
5.	Bimola	Bimola
6.	Katarmal	Katarmal

Under the Gram Sabha's Dhari has five Gram Sabha's, Chan, Jyoli, Kaneli, has two Gram Sabha's each and Katarmal and Bimola has a Gram Sabha's each. All the villages lie on a hillock except Jyoli, which lies partly on hillock and partly in valley.

All the villages surveyed lies on the road from Almora to Sitlakhet. Jyoli, Kuneli, and Bimola lies on the Almora-Sitlakeht road which is non-metallic.

All the villages surveyed are electrified. Kuneli Gram Sabha has the highest electrification percentage (100%), while Jyoli Gram Sabha has the lowest electrification percentage (20%). Other sources of illumination in the villages are petromax and kerosine lamp.

Approximately 25% of the households own a gas cylinder to cook food. While the other household depends on firewood for cooking.

Drinking water is available in the villages but it is not adequate to fulfil all their requirements. Agriculture is mainly rain-fed and there is no provision for irrigation of the Agriculture fields, which is creating a major hindrance in the development of the villages.

Table 2: Social Structure

Socio-economic profile										
		Caste distribution (%HH)*			Households#	Population#			Literacy#	
Gram Sabha	Villages	Thakur	Brahmin	Harijan		Male	Female	Total	male	Female
Dhari	Dhari	10-20-	60-65	20-25	50	150	156	306	78	35
	Jolswar				27	72	71	143	35	19
	Latwalgaon				NA	NA	NA	NA	NA	NA
	Tani				11	26	33	59	13	8

Socio-economic profile										
		Caste distribution (%HH)*			Households#	Population#			Literacy#	
Gram Sabha	Villages	Thakur	Brahmin	Harijan		Male	Female	Total	male	Female
	Sanachad				NA	NA	NA	NA	NA	NA
Chan	Chan	40	35	25	52	128	133	261	77	39
	Naugaon				31	58	99	157	45	43
Jyoli	Jyoli	30	50	20	101	228	245	473	136	45
	Kharkuna				25	54	75	129	35	29
Kuneli	Kuneli	35	40	25	59	120	128	248	87	56
	Bisra				29	79	72	151	50	28
Bimola	Bimola	45	52	3	87	245	264	509	131	61
Katarmal	Katarmal	50	46	4	112	252	217	469	124	49

Note: * Datas available from PRA data

Datas available from National Information Center

NA Datas not available

Population:
The villages surveyed were not very populated, with the least population at Tani and the highest population at Bimola (Table No. 2). The average no family members per household is five to six. For example at Katarmal, according to the household survey the average no of family members per household is six (Appendix 1). Almost all households have atleast one or two family members who have migrated to the bigger cities in search of better livelihood.

Castes:
There are mainly three castes in all the villages surveyed namely the Thakurs, Brahmins and the Harijans. The distribution of the castes in all the Gram Sabha is given in the above table. The percentage household for each caste is obtained at the Gram Sabha for all the villages that come under that Gram Sabha. The Harijans have their own locality within the same village, while the other two castes in all the villages lives in association with each other. The caste classification was found at only the Gram Sabha's together for all the villages under it.

Classes:
The villagers can be roughly divided into three classes on the basis of their land holdings.

- Poor: They have upto 12nalies land, which is not sufficient to sustain their life. These people work as laborers either in their villages or outside according to the availability of work. Each family has either two or three cattle.
- Middle class:

They have upto 50 nalies. Besides farming members of the family are either in service or in business. Each family has 5 to 6 domesticated animals.

- Rich: Families possessing more than 50 nalies are considered as the rich. These families have highbred domesticated animals. Besides farming members of the family are either in service or in business

Language:
Hindi and Kumauni is spoken by the villagers.

Women:

Women in the villages have hardly any time to spare, as they have to do the majority of the work. They do most of the farming activities except ploughing, which is done by the men. Sowing, harvesting, threshing and all the household activities are done by the women folks.

Literacy:

The villagers of the villages surveyed do not compromise on education. Both men and women are educated and only the old people are illiterate

About one third of the women are educated. All the children both boys and girls are given education.

Each village has atleast a primary school. Thus a greater majority of the villagers have atleast a primary level education.

Table 3: Infrastructure

Village	Dhari-GS	Chan-GS	Jyoli-GS	Kuneli-GS	Bimola-GS	Katarmal-GS
Approach Rd	Almora-Sitlakhet	Almora-Sitlakhet	Almora-Ranikhet	Almora-Ranikhet	Almora-Sitlakhet	Almora-Ranikhet
Status	Non Metallic	Non Metallic	Metallic	Metallic	Non Metallic	Metallic
Length (km)	0 Km	0 Km	2	1.5	0 Km	3
Infrastructure Facilities						
District HQ	Almora (24 Km)	Almora (20 Km)	Almora (18 Km)	Almora (20 Km)	Almora (12 Km)	Almora (15 Km)
Block HQ	Hawalbag (15 Km)	Hawalbag (12 Km)	Hawalbag (7 Km)	Hawalbag (8 Km)	Hawalbag (6 Km)	Hawalbag (5 Km)
Panchayat Bhavan	-	Chan	Jyoli	-	Bimola	Katarmal
Forest RO	Almora (24 Km)	Almora (20 Km)	Katpuria (5 Km)	Almora (20 Km)	Almora (12 Km)	Almora (15 Km)
Forest DO	Almora (24 Km)	Almora (20 Km)	Almora (18 Km)	Almora (20 Km)	Almora (12 Km)	Almora (15 Km)
Horticulture Dept	Sitlaket (12 Km)	Sitlaket (12 Km)	Katpuria (5 Km)	Almora (20 Km)	Almora (12 Km)	Almora (15 Km)
Post Office	Dhamas (2 Km)	Dhamas (4 Km)	Jyoli	Jyoli (2.5 Km)	Shyalidar (2.5 Km)	Kosi (3 Km)
Nearest Main road	Dhari	Chan	Jyoli	(4 Km)	Bimola	(3.5 Km)
Vet Hospital	Dhamas (2 Km)	Dhamas (4 Km)	Hawalbag (7 Km)	Hawalbag (8 Km)	Bimola	Kosi (3 Km)
Kindergarten	Dhari	-	-	-	Bimola	Katarmal
Primary schools(Till Class 5)	Dhari	Chan	Jyoli	Kuneli	Bimola	-
Inter school (Till Class 12)	-	Chan	Jyoli	Jyoli (2.5 Km)	-	Jyoli
Colleges	Almora (24 Km)	Almora (20 Km)	Almora (18 Km)	Almora (20 Km)	Almora (12 Km)	Almora (15 Km)
Electricity (% HH)	60	50	20	100	60	50

All the villages surveyed had their District Headquarters', Forest Division Office's and Colleges for higher studies at Almora, while the Block Headquarters' at Hawalbag. All the villages had their own Panchayat Bhavan's in their Gram Sabha village except the villages under Dhari and Kuneli Gram Sabha which didn't have a Panchayat Bhavan. All the villages had their Forest Range Office at Almora except Jyoli which had at Katpuria. Kuneli Bimola and Katarmal had their Horticultural Department at Almora, where else Dhari and Chan had at Sitlakhet and Jyoli had it's Horticultural Department at Katpuria. Each village surveyed had a primary school in the Gram Sabha and Dhari and Bimola had a Kindergarten School. Villages of Dhari and Chan takes their Live Stock to the Veterinary Hospital at Dhamas, Jyoli and Kuneli at Hawalbag and those of Bimola and Katarmal at Bimola and Kosi respectively. Jyoli and Kuneli Gram Sabha had a common Post Office at Jyoli, Dhari and Chan at Dhamas, Bimola and Katarmal at Shyalidar and Kosi respectively.

A majority of the houses in the villages are Kaccha, for e.g. At Katarmal 20% household sampling was carried out and it was found out that of the 21 households sampled 4 houses were puckka.

RESOURCE USE

Table 4: Land holding and soil type

Gram Sabha	Village	Total Area^ (ha)	Agricultural land: Irrigated# (ha)	Unirrigated^ (ha)	Current Fallow* (ha)	Cultivable waste*	Uncultivable waste*	Forest Land: Revenue Department(acres)$: Civil/ Soyam	Van Panchayat	Total	Soil type (Area covered in %)
Dhari	Dhari	194.11	0.228	30.4	3.073	0	0.366	64.76	-	64 76	Sandy(80%) Red mud(10-15%) Rocky(5-10%)
	Jolswar	167.98	NA	122.75	6.46	12.69	0	16.05	-	16.052	
	Latwalgaon	137 6	NA	56.23	0	35.18	1.203	24.4	-	24 4	
	Tani	77.18	NA	41.69	0.37	6.46	1.88	11	-	11	
	Sanachad	NA	NA	NA	10.51	13.55	0 192	NA	-	-	
Chan	Chan	482.13	3.108	165.43	NA	NA		118.39	-	118.388	Domat(20%) Sandy(60%) Rocky(20%)
	Naugaon	306.64	NA	191 39	NA	NA	NA	44 68	-	44.68	
Jyoli	Jyoli	759.02	NIL	201.02	NA	46.68	0	187.81	-	187.81	Sandy and stony(100%)
	Kharkuna		NA	NA	NA	NA	NA	NA	-	-	
Kuneli	Kuneli	173	NA	100.2	NA	11.84	0	64 93	-	64 93	Sandy and stony(100%)
	Bisra	118.76	NA	39.78	NA	28.2	0	51 72	-	51.72	
Bimola	Bimola	511.45	NA	218.63	NA	NA	NA	27 6	21 5	49 1	Domat(50%) Sandy(40%) Rocky(10%)

Gram Sabha	Village	Total Area^	Agricultural land					Forest Land			
		(ha)	Irrigated# (ha)	Unirrigated^ (ha)	Current Fallow* (ha)	Cultivable waste*	Uncultivable waste*	Revenue Department(acres)$			Soil type (Area covered in %)
								Civil/ Soyam	Van Panchayat	Total	
Katarmal	Katarmal	800 04	NIL	340 19	NA	NA	NA	137.65	31 87	169.52	Sandy and stony(60%) Domat(40%)

Datas form the PRA *Datas from the Patwai ^ Datas from the Tehsil $Civil Forest Department NA: Datas not available

Land

According to the data's available from the Patwari, Revenue and Forest Department the total land under various uses are as follows

(i) Forest
(ii) Agriculture
(iii) Pasture and others

(i) Forest

Forests in the villages are of two types Van Panchayat and Civil Forests.

Van Panchayat forests are mainly dominated by Chir and Baaj trees. These two species are equally distributed in this forest areas of the villages surveyed. The villagers take active role in the protection of Van Panchayats. Van Panchayat Committees are formed to take care of the Van Panchayats. It was found from the field survey that the Van Panchayats are better stocked than the other forests. There are very few Van Panchayat forests in the villages surveyed. There is only a Van Panchayat at Bimola and Katarmal.

The Civil Forests are various stages of degradation. Bhimal, Kharik, Pine and other trees are badly lopped for fodder and fuelwood. Forests are usually under stocked, open and poor in natural regeneration due to heavy biotic pressure as grazing is carried out in this forest.

(ii) Agriculture

Inspite of so many physical constraints agriculture is the dominant occupation of the villages taken into consideration. The main crops in Kharif are mandua, paddy, soyabean, etc. In Rabi wheat,barley, lentils, pea etc. The crop yield is mainly dependent on rains as there is no other source of irrigation. Thus if the rain fails, the crop also fails. The crop yield is also poor as the farmers usually do not use fertilizers and high yielding varielty seeds. Scattered and fragmented land holdings contuibute largely to un-economical agriculture. Monkeys also damage the harvest as they consume the agricultural products.

Agriculture ismainly rain fed. About 3% of the area is irrigated at Chan and Dhari

At Katarmal from the household survey it was found out that the average land holding per family was 20 nalis. The Agricultural land holding varied from 2 to 32 nalies and there was one family who did not have any Agricultural land.

A typical crop cycle for this area is displayed in (Appendix. 3) If there is adequate rainfall, there are two crops sown in a year, Kharif and Rabi. The Kharif crop is sown between May and June and harvested in September-October. The Rabi crop is sown in October-November and harvested in April - May. The main Kharif crops grown in this area are paddy, madua, urad dal, kala bhat, potato, onion, methi, spinach and soya bean. The main Rabi crops are wheat, masoor, channa and mustard. Vegetables like turiya, cucumber, lauki, capsicum are grown mostly during the rainy season. Most of the sowing is done by hand. The primary source of fertilizer in this region is manure (cow dung). Urea is used to a lesser extent and only for specific crops. Field repair and maintenance takes place during February and March.

(iii) Pasture:
Some villages like Dhari, Jyoli, Tani, Jolswar. Kuneli and Bisra have pasture lands locally called *Gochars*. Villagers take their own livestock to these pasture lands, tie them to posts and they are left there to graze in the daytime and are stall feed during the morning and night time.

Land holding:
No distinct classification of land holding has been available in any of the villages either from the Patwari's or from the villagers themselves. There is no such family in any of the villages who does not have any land nor are there any family who owns more than 5 acres of land in any of the villages surveyed.

Soil type:
In the Gram Sabha the villagers are of the opinion that there are mainly three kinds of soil namely domat(clayey), sandy and rocky. Domat and sandy soil is used for farming and rocky soil is used for Forestry. Soil type classification of the villages are given in (Table 4....)..

LIVELIHOOD/ECONOMY

Occupation:
The villagers in the villages have almost the same occupation. All of them engage themselves in farming, while some are in service mainly in the Army either in the state or outside it. There has been a lot of migration in the past few years mainly in the big cities in search of better livelihood.

The people of the villages are 100% Hindu and all of them perform pujas and rituals. Some of them also do manual labour as an additional source of income.

At Katarmal each household expenditure is Rs. 2619 per month 9Appendix...1).

Agroforestry:
Agroforestry system has been suggested to meet the need of local people for fuel and fodder in addition to agriculture crops.

The preferred motivating agent for agro-forestry adoption is from the Block Division Office. The other preferred agents are Agricultural Department and Forestry Department. The constraints faced by agro-forestry practicing households in all the villages surveyed are technical information, market information, permit related and land related(non availability of land /crop loss) issues.

The constraints for not adopting agro-forestry is mainly due to lack of technical information, crop loss due to water shortage. In all the villages surveyed the villagers complained crop loss due to monkeys also.

The villagers also expressed that they wanted more information on technical aspects, species related, land related, nursery techniques, market related and also permit related issues.

Gosti/ Panchayat meetings were the most preferred medium of information in all the villages. At Kaneli people also preferred posters next to Gosties.

The preferred medium of information dissemination is different for almost all the Gram Sabha's. At Kaneli and Jyoli Horticulture and BDO (Block Development Office) were preferred, where else villagers of Chan preferred the NGO's.At Bhimola and Dhari Forest Department and Agricultural Department were preferred and at Katarmal BDO (Block Development Office) was preferred. As the medium of information dissemination.

Table 5: Resource table

S no.	Type of dependence	Species used	HH (%)	Source	Extend of dependence	USAGE
1	FUELWOOD	Mahal, Chir*, Khair, Tun	100	Forest	Nov.-Jan.	Household consumption
2	fodder	Madwa's stock, Wheat *stalk, Majra's stalk, Paddy*'s stalk, Gajio grass, Bhat, Urad, Soyabean*, Masoor, Bhimal, Bhikula, Khanik, Baj leaves. Betayan	100	Forest and homesteads	Nov.-Jan.	Household consumption
3	Medicinal plants	Hewai, Amla, Kilmor, Dhatura, Chamarmou, Bhimal, Dalim, Hazari flower, Reetha,	50	Forests and homesteads	All the year round	Very rarely used
4	Horticultural plants	Lemon*, Akhrot, Malta, Pears*, Khumanı, Peach, Banana, Guava, Beru	98	Homesteads	All the year round	Household consumption and sometimes sold
5	Agricultural species	Wheat*, Paddy*, Bajra*,Madwa, Madira, Got, Mat, Looki, Setaphal, Groundnut*, Akhrot	100	Agricultural lands	All the year round	Household consumption

Note: * Trade names
Rest are the local names

Medicinal Plants

It was found that there is a variety of medicinal plants in the villages surveyed, but the villagers are unaware of it's medicinal properties. Those who are aware of it have the opinion that due to the popularity of Allopathic medicines, the indigenous medicinal plants are losing it's ground. The different medicinal plants found in the villages are as in the (Table No. 5).

Horticultural plants: The villager grow horticultural plants near their houses. Citrus fruits are very popular in the localities surveyed. They are mostly grown to cater the household consumption and are very rarely marketed to Kosi and Almora.

Fodder:
All the household in the villages have atleast on livestock whether it be cow, buffaloes or goats. According to the villages surveyed one-third of the fodder need is supplemented by the green leaves collected from the forest. The women expressed that the leaves of Bhimal and Kharik are best for fodder, but due to it's scarcity leaves of Banj are the most widely used fodder.

Grass from the jungles are also used as fodder. The villagers opine that approximately 40% of the fodder need is met from grasses.
Agricultural wastes like dried stalk of wheat, paddy, madwa are also used as fodder when these crops are harvested.

Fodder collection is mainly done by the women folks and sometimes the children help them after their school. November to March is the season when fodder collection form the jungles is done, to be stored for use throughout the year. From the household survey (Appendix 1) at Katarmal it was observed that the villagers have to walk an average distance of 3.7 km, which takes them 4 hours to collect fodder. During the other part of the months fodder is also collected form the homesteads.

Household survey at Katarmal shows that the fodder requirement per month for cow and buffaloes are 513 Kg and 583 Kg respectively (Appendix 1).

Fuelwood:
Baj is the best fuelwood tree according to the villagers and next to it Baransh. Due to the scarcity of these two species the villagers use Chir as fuelwood, which is abundantly available in the forest. The other fuelwood species used are Toon, Khair, Mahal and Tilmora.

The household survey at Katarmal shows that an average of 298Kg of wood per month is required, of this 230 Kg/month is used for cooking and 64 Kg/month is used to ward off the cold (Appendix 1).

Fuelwood collection is also done by the women folk and it is collected in the same season as fodder.

WATER
There are large no. natural water sources in the villages mainly perennial streams. All the villages surveyed had drinking water facility. Tanks had been constructed by the Swazal Yojna, sponsored by the World Bank to provide water in most of the villages. Jal Nigam has also contributed in providing drinking water. Water from the streams in the jungles are transported through pipe lines to be stored in tanks to be again distributed at different locations in the village. The villagers have to walk long distances to fetch drinking water e.g. At Katarmal the villagers walk an average of 743 m, which takes them about 3 hours (Appendix 1).

There is a scarcity of water in the months of May-July during which the supply of water reduces. The water supply is inadequate to cater the needs of the villagers throughout the year.

Villages that are on the hill tops and having water sources down in the valleys face problem as there is no facility for the lifting the water.

Agriculture ismainly rain fed. About 3% of the area is irrigated at Chan and Dhari. Crops fail due lack of irrigation facilty as the monsoons are also irregular in the area.

Table No.6 Work Schedule (Month-wise)

SL. No.	Month(Hindi calendar)	Women	Men
1	Chet (15 March-15 April)	Sowing of paddy and collection of fodder	Ploughing of field
2	Vashaki (15 April-15 May)	Harvesting of wheat and cutting of grass	Threshing of wheat
3	Jhet (15 May-15 June)	Sowing of Madwa	Ploughing the field
4	Ashar(15 June-July15)	Weeding paddy field	Ploughing the field
5	Sawan(15 July-15 August)	Weeding of Madwa field and cutting of grass	Preparation of bunds along the fields
6	Bhadra(15 August-15 September)	Harvesting of Madira	-
7	Aashoj(15 September-15 October)	Cutting of grass, harvesting of Madwa and Paddy	-
8	Karthik(15 October-15 November)	Harvesting of Dal and sowing of Paddy	Ploughing the field
9	Mangksor(15 November-15 December)	Sowing of wheat and cutting of grass	Ploughing the field
10	Posh(15 December-15 January)	Collecting firewood and fodder from forest	-
11	Magh(15 January-15 February)	Collecting firewood and fodder from forest and sowing of potatoes	Sowing of potato
12	Phalgoon(15 February- 15 March)	Cleaning and repairing of fields and transporting cow dung to the fields	Ploughing the field

Table No. 7: SEASON WISE WORK SCHEDULE OF WOMEN

Time/Season	Dawn to 9 A.M.	9A.M. to 12A.M.	12A.M. to 4 P.M.	4P.M. onwards
Winter	1. Milking of cattle and cleaning their sheds 2. Cooking food and preparing children for school 3. Collection of water	1. Go to the jungle for fodder collection 2. Repairing of fields, transporting cow dung to the fields	1. Sowing wheat, jowar, mustard seed, potatoes and weeding 2. Feeding cattle fodder and water 3. Household chore 4. Collection of fuel wood	1. Milking cattle 2. Collection of water 3. Feeding family 4. Household chore and then sleep at 9 P.M.-
Summer	1. Get up at 5:30 2. Milking of cattle, feeding them fodder and water and cleaning sheds of livestock 3. Collection of water 4. Cooking food and preparing children for school 5. Collection fuelwood and fodder from homesteads	1. Harvesting and threshing jowar, mustard seeds 2. Leveling field after ploughing by men and application of cow dung in the field	1. Household chore and preparing food 2. Feeding cattle fodder and water	1. Sowing of paddy, bhat, ghat, madwa 2. Digging out potato tubers 3. Collection of water 4. Livestock related work 5. Cooking food and feeding family 6. Sleep at 11P.M.
Monsoon	1. Get up at 6 A.M. 2. Milking cattle. feeding them fodder and water	1. Weeding agricultural lands from the fields	1. cooking food, household chore 2. feeding cattle	1. Field related work and collection grass

Time/Season	Dawn to 9 A.M.	9A.M. to 12A.M.	12A.M. to 4 P.M.	4P.M. onwards
	and cleaning sheds of livestock 3. Cooking food and preparing children for school 4. Go towards jungle for collection of grass	2. Harvesting paddy	fodder and water	2. Feeding cattle fodder and water 3. Cooking food and looking after kids 4. Household chore 5. Sleep at 10 P.M.

Livestock details as per secondary literature:

The three block covered in the study are Tarikhet, Daurahat and Hawalbag

Table No.8: General description of the blocks (1991)

BLOCK	Area (square Km)	No. of houses	Total no. of Panchayats	Total no. of Panchayat houses	Total no. of Gram Sabha	Population Male	Female	Total
Tarikhet	243.2	12596	11	10	103	31456	34423	65897
Daurahat	207.4	12446	11	15	111	27016	33184	60200
Hawalbag	201.8	11812	10	22	106	28793	30434	59227

Table No.9: Cow census as per 1993 census in the three blocks are as follows:

Block	Male Cow above 3 years of age	Female cows above 3 years of age	Cows below 3 years of age	Total	Male Cows above 2.5 years Of age	Female cows above 2.5 years of age	Cows below 2.5 years of age	Total
Tarikhet	11810	9301	3491	24602	205	133	114	452
Daurahat	6369	4984	5322	16675	114	288	155	557
Hawalbag	9374	7928	7190	24492	15	24	15	54

Table No.10: Cattle census as per 1993 census:

Block	Local bred sheep	Cross bred sheep	Total cattle	Total goats	Horse and mule	Pig local bred	Pig cross bred	Total pigs	Other cattle	Total cattle	Total poultry	Other birds	Total birds
Tarikhet	-	-	0	12429	12	10	0	10	1314	49379	3605	-	3605
Dauraha t	-	-	0	4942	4	-	-	0	1553	28010	2844	-	2844
Hawalba g	-	0	0	12846	70	-	-	0	1824	48231	6388	-	6388

Table No.11: Infrastructure for Live Stock:

Block	Veterinary hospital	Veterinary improvement center	Artificial center	Insemination sub center	Animal Husbandry farm	Sheep improvement center	Piggery Improvement Center	Piggery Union	Poultry Union
Tarikhet	2	4	2	-	-	-	-	-	-
Daurahat	4	5	2	8	-	-	-	-	-
Hawalbag	5	6	5	3	1	-	-	-	-

Table No. 12: Livestock details as per the PRA conducted:

SL no.	Gram Sabha	Cow			Buffaloes			Bull			Goat			Poultry		
		HHs	Total	Nos. per family	HHs	Total	Nos. per family	HHs	Total	Nos. per family	HHs	Total	Nos. per family	HHs	Total	Nos. per family
1	Dhari	50	50	1	60	75	1 or 2	165	165	1	23	53	3 or 4	-	-	-
2	Chan	80	100	1 to 2	30	30-35	1 to 2	100	100	1	25	30	3 to 4	-	-	-
3	Jyoli	100	200	1 to 2	60	90	1 to 2	60	80	1 to 2	60	150	2 to 3	3	12	3 to 4

4	Kuneli	45	60	1 to 2	30	30	1	25	25	1	10	30	4 to 5	2	2	1
5	Bimola	45	50	1 to 2	200	200	1	100	100	1	50	100	2 to 5	-	-	-
6	Katarmal	99	150	1 to 2	40	45	1 to 2	95	145	01-Feb	99	210	2 to 3	20	100	3 to 4

The no. of buffaloes are less as compared to the no. of cows as the consumption of fodder by the buffaloes are more as compared to cows and there is scarcity of fodder due to which the villagers are forced to keep lesser no. of buffaloes.
Cows, buffaloes are reared for milk and other dairy products. These are used for household consumption and are also sold.
Bulls are reared for ploughing the fields.
Goats are reared for meat for local consumption.
Poultry are reared for eggs and meat. These are used for household consumption.

At Bhimola Pine needles is used for livestock bedding.

Table No. 13: Milk production and dairy development:

Gram Sabha	Litres of milk per day		Marketing of milk products					
	Cow	Buffaloes	Milk (Rs./litre)	Dahi (curd) Rs./kg)	Khoya Rs./kg)	Ladoo Rs./kg)	Balmithai Rs./kg)	Khoya Rs./kg)
Dhari	½ to 1	4	10	-	-	-	-	-
Chan	½ to 1	4	10	-	-	-	-	-
Jyoli	1	4	10	-	-	60	80	80
Kuneli	½ to 1	4	10	-	-	-	-	-
Bimola	½ to 1	4	10	-	-	-	-	-
Katarmal	1	2.5	10	20	18	-	-	-

The cow and the Buffaloes are milked twice daily.

Marketing

Dahi and Khoya are prepared from the milk and sold either at Kosi or Almora.

Table No. 14: Fodder used particulars

Sl No.	Gram Sabha	Type of fodder	Source of fodder	Time frame/season
	Dhari	Agricultural waste, grass and leaves and tender twigs of fodder species like Bhimal	Agricultural field, homesteads and jungles	Nov. to Feb.
	Chan	Agricultural waste, grass, leaves of Kilmora, Hisaloo, Kharik, Bhimal	Agricultural fields, Homesteads and Forest land	Agricultural fields, Homesteads and Forest land
	Jyoli	Madwa's stalk, wheat stalk, majra stalk, paddy stalk, paral	Agricultural fields	These crops are left in the field after their harvesting and are collected mainly in the month Nov. to Jan.
		Bhat, urd, soyabean, masoor	Agricultural fields	Collected after they mature in the fields
		Gajio grass and other grass species	Gochar(grazing fields), forest lands	Animals are grazed here throughout the year especially during the daytime as per the availability of the grass
		Bhimal, Kharik,Betayan	Homesteads and forest lands	Collected throughout the year by lopping of the branches
	Kuneli	Madwa's stalk, wheat stalk, majra stalk, paddy stalk	Agricultural fields	These crops are left in the field after their harvesting and are collected mainly in the month Nov. to Jan.
		Bhat, urd, soyabean, masoor	Agricultural fields	Collected after they mature in the fields
		Gajio grass and other grass species	Gochar(grazing fields), forest lands	Animals are grazed here throughout the year especially during the daytime as per the

Sl No.	Gram Sabha	Type of fodder	Source of fodder	Time frame/season
				availability of the grass
		Bhimal, Kharik, Betayan	Homesteads and forest lands	Collected throughout the year by lopping of the branches
	Bimola	Agricultural waste, grass and leaves and tender twigs of fodder species like Bhimal.	Agricultural field, homesteads and jungles	Nov. to Feb.
	Katarmal	Madwa's stalk, wheat stalk, majra stalk, paddy stalk, paral	Agricultural fields	These crops are left in the field after their harvesting and are collected mainly in the month Nov. to Jan.
		Bhat, urd, soyabean, masoor	Agricultural fields	Collected after they mature in the fields
		Gajio grass and other grass species	Gochar(grazing fields), forest lands	Animals are grazed here throughout the year especially during the daytime as per the availability of the grass
		Bhimal, Kharik,Betayan	Homesteads and forest lands	Collected throughout the year by lopping of the branches

Table No. 15: Fodder available (month-wise) for Kosi area

SL. No.	Month	Fodder available for the live stock
1	Chet (15 March-15 April)	Gajio,paral, grasses growing on the wheat field, leaves of Baj, leaves of Kayoj
2	Vashaki (15 April-15 May)	Gajio, paral, dried stalk of wheat and jowar, leaves of Baj and Kayoj
3	Jhet (15 May-15 June)	Gajio, paral, dried stalk of wheat and jowar, leaves of Baj and potatoes
4	Ashar(15 June-July15)	Grasses growing in the jungles (visia, gorhiya, namuj, savam, balriya, kumriya) and to some extent grasses growing in the agricultural fields and hay
5	Sawan(15 July-15 August)	Grasses growing in the jungles and agricultural fields
6	Bhadra(15 August-15 September)	Grasses growing in the jungles and agricultural fields
7	Aashoj(15 September-15 October)	Grasses growing in the jungles and agricultural fields,

8	Karthik(15 October-15 November)	Vhiu grass and Bhimal, kharik, Baj, and paral
9	Margshis (15 November-15 December)	Vhiu grass, Bhimal, kharik, Baj and paral
10	Posh (15 December-15 January)	Bhimal, kharik, Baj, paral and grasses brought from the forest
11	Magh (15 January-15 February)	Bhimal, khirik, Baj , paral and leaves of mustard plant
12	Phalgoon (15 February- 15 March)	Baj, paral and leaves of mustard plant

Feed:
Fodder is brought in head loads by the women of the villages twice daily in the months of Nov. to March. Women bring about 30-35 Kg per head loads.

Cow, Buffaloes, and goats requires fodder at the rate of 5, 10 and 5 kg. per day
Poultry feed includes grains of paddy along with the husk, madwa, and powdered bone

Grazing:
The cattle are taken for grazing during the day time in the *gochar or* forest lands (Reserve Forest) by one of the family members possessing them and during the morning and night time they are stall feeded.

There is no fodder bank in any of the villages. People of the make silage or hay to feed the animals.

People of the villages are willing to reduce the no. of their livestock in exchange of upgraded local bred cattle.

Breeding:
Natural insemination is mainly used (almost 95%)
Artificial insemination is rarely used (almost 5%)

MANAGEMENT PRACTICES

a) **Care of Milch animals:-** No special care is provided.
b) **Care of pregnant animals:** No special is provided. They are kept along with the rest of the herd. No special feed is provided.
c) **Care during calving:** After calving the mother and the offspring are kept separately and are provided with nutritious feeds and extra feed like madwa, gajio grass, soyabean according to the availability of the fodder.
d) **Care of young stock:** Milk and chapati are fed.
e) **Non- Productive cattle:** They are kept along with the rest of the herd and are treated normally

DISEASES:

The three main diseases affecting the cattle are
1)Gal ghoto- In this there is swelling in the neck of the cattle
2) Khurpaka- Symptom- swelling in the neck
3)Mu paka- Symptoms – Blisters appear on the mouth of the cattle
4) Kiriya Symptoms- It is similar to tuberculosis

These diseases mainly affect cow, buffaloes and goats. These mainly affect the cattle in the rainy and winter seasons.
The villagers have the opinion that the cattle that are affected in the rainy season are curable but those affected in the winters are incurable.
Prevention and control of diseases: No preventive measures are carried out and the cattle is affected by the diseases they are taken to the Veterinary Hospital at Kosi.
Dead animals: Sick and dead animals are not sold for meat. The dead animals are buried and the sick animals are treated to cure their ailments.
Poisoning cases: No such cases has been observed.

Veterinary Hospital: Vetennary Hospital at the different Gram Sabha's are given in the table no...20.........Household survey at Katarmal (Appendix 2) shows that the distance of village form nearest Veterinary Hospital/dispensary/Artificial Insemination centre is 12.5 Km.No treatment is provided at the door step.
Vaccination was is not done regularly and the people were not satisfied with Animal Husbandry. There is no stockman in the villages. No treatment is provided at the doorstep, the ailing animals are taken to the nearby Veterinary Hospital for treatment.
People were bitter towards the animal Husbandry Department

There has not been any livestock improvement programs at present and in the past too.

Household survey at Katarmal (Appendix 2) shows that out of 21 households surveyed fourteen households had cows, twelve households had Bullocks seven households had goats and five households had Poultry with an average of 2,2, 4 and 7 numbers per household respectively. There is no sheep, horse or piggery in the village. Natural Insemination is preferred and they do not cross bred their cows.
Maximum production of milk form a cow and buffalo is 1.84 and 6.25 litres per day. There is no cooperative for marketing of milk, wool or eggs.
the fodder requirement per month for cow and buffaloes are 513 Kg and 583 Kg respectively. Animals are taken for grazing in the forest during which the family members accompanies them. There is no fodder bank located near the village. 100% of the household surveyed make silage/hay. No household sells their milk products. (Appendix).
At Katarmal the distance of village form nearest Veterinary Hospital/dispensary/Artificial Insemination centre is 12.5 Km. No treatment is provided at the door step. Vaccination was not done regularly and the people were not satisfied with Animal Husbandry

Table No. 16: Ongoing and completed Government programs

SL. No.	Program	Villages	Sponsoring agency	Type of work	Year	Local agency	Status
1	Swazal Yojna	Katarmal	World Bank	Two Tanks were constructed to provide drinking water	2000	Gram Panchayat	Ongoing
		Chan		Tanks were constructed to provide drinking water	1999		Ongoing
2	Jawahar RojgarYojna	Katarmal	Central Govt.	1) Training on sewing and knitting 2) Education of adults 3) Preparation of compost pit 4) Cleaning construction of roads 5) Funds were provided for the construction of sanitary pits	2000	Block	Ongoing (beneficiaries are very less)
		Jyoli (two revenue villages)		Road repairing and 2-3 houses were build for the BPL (Below Poverty Line)	2000		Ongoing (beneficiaries are very less)
		Kaneli (two Gram Sabha)		Road repairing	1980		Not active at present
	Angan Bari	Katarmal	Central Govt.	3 to 5 years children are given education free of cost. Dahlia and biscuits are distributed at frequent intervals(two months) to children and pregnant women. Pregnant women are briefed as to how they can take care of their health			
	Van Panchayat	Bhimola	World Bank	Plantation	1998-99	Van Panchayat	The program failed badly (plantation did not take place)
		Dhari (four revenue villages)	Chia	Plantation of oak, fruit trees and a tank was built for supplying water	1989	Local Panchayat	(successful)

SL. No.	Program	Villages	Sponsoring agency	Type of work	Year	Local agency	Status
	Jal Sansthan	Chan (two revenue villages)		Tanks, taps and stand post were constructed	1969		No longer active
		Dhari	Chia	Tanks, taps and stand post were constructed	1997		Ongoing
	Bal Poshan Aahar	Jyoli (two Gram Sabha)	Govt. of India	3 Kg. rice/child/month is distributed at frequent intervals	1998	Block	Ongoing
		Kaneli (two Gram Sabha)	Govt. of India	3 Kg. rice/child/month is distributed at frequent intervals	1993-94	Block	Ongoing

Recommendations and suggestions:

Some of the major constraints in the hilly terrain of the study are are:-

- High relief
- Sparse vegetation
- Rugged mountain terrain
- Low rainfall
- Depletion of water in springs and streams specially in summers
- Uneconomical agriculture production
- Frequent occurrence of mass movement
- Stream and road banks erosion
- Non availability of ground water in majority of areas
- Lack of technical know-how
- People of the villages were not aware of utility and importance of different medicinal plants available in the area.
- Women of the area are heavily stressed as they do all the household and farming activities, except ploughing which is done by the men. Men are drunk most of the time and they do not help the women in their work.

Following activities can be suggested in the study area for conservation of soil and water: -

Surface water:

- Check dam with diversion channel
- Spring storage tank
- Roof top rain water harvesting structure

Ground water:

- Area suitable for borewell
- Area suitable for dugcum borewell/handpump

Soil Conservation:

- Nala bund
- Soil conservation/slope protection\stream bank protection
- Road protection

Others:

- Livestock development programs
- Income generation schemes like, training programs for sewing, knitting, handicraft work and establishing cooperatives to help in marketing of the end products. The villagers at Bhimola wanted such activities to be carried out in their village.
- Organizing Cooperatives for marketing of Horticultural products and medicinal plants.
- Organizing Gosties to inform the villagers the importance of medicinal plants and their utility and how they can generate income through it.
- Careful monitoring of the ongoing programs so that the villagers get benefit.
- Programs for the condition of women is mandatory.

Appendix 1:

SOCIO-ECONOMIC DATA of KATARMAL VILLAGE

Name of the Village	Katarmal	Katarmal	Katarmal	Katarmal	Katarmal	Katarmal	Katarmal	Katarmal	Katarmal	Katarmal	Katarmal
Name of the Head of Family	**Bhagwant Singh**	**Divan Singh**	**Kushal Singh**	**Bishen Singh**	**Jaman Singh**	**Lal Singh**	**Krishna Devi**	**Pan Singh**	**Badri Singh**	**Gopal Singh**	**Kanhiya Singh**
Age	46yrs	60yrs	75yrs	55yrs	50yrs	50yrs	65yrs	45yrs	36yrs	50yrs	52yrs
Caste (SC/ST)	Rajput	Hindu (Rajput)	Hindu (Rajput)	Hindu (Rajput)	Hindu (Rajput)	Hindu (Rajput)	Hindu (Rajput)	Hindu (Rajput)	Hindu (Rajput)	Hindu (Rajput)	Hindu (Rajput)
Language Known	Hindi, Kumaun	Hindi, Kumaun	Hindi, Kumaun	Hindi, Kumaun	Hindi, Kumaun	Hindi, Kumaun	Hindi, Kumaun	Hindi, Kumaun	Hindi, Kumaun	Hindi, Kumaun	Hindi, Kumaun
Number of Family Members	7	5	8	3	5	4	3	4	4	7	10
(Age/M or F/Ed. or UEd./ Ma or Unma)	**Bhagwant Singh**	**Divan Singh**	**Kushal Singh**	**Bishen Singh**	**Jaman Singh**	**Lal Singh**	**Krishna Devi**	**Pan Singh**	**Badri Singh**	**Gopal Singh**	**Kanhiya Singh**
	46/M/ED/MA	60/M/UNED/MA	75/M/ED-P/MA	55/M/ED-P/MA	50/M/UNED/MA	50/M/ED-P/MA	65/F/UNED/MA	45/M/ED/MA	36/M/ED/MA	50/M/ED/MA	52 M LD/MA
	Ganga Devi	**Bachli Devi**	**Uma Devi**	**Madhuri Devi**	**Kamala Devi**	**Madhuri Devi**	**Bachhi Singh**	**Raju Devi**	**Kamla Devi**	**Jayanti Devi**	**Lalita**
	36/F/ED/MA	55/F/UNED/MA	70/F/UNED/MA	45/F/ED-P/MA	35/F/ED-P/MA	38/F/UNED/MA	35/M/ED/MA	35/F/ED/MA	25/F/UNED/MA	45/F/ED/MA	48/F/LD/MA
	Veena	**Anand**	**Sunder Singh**	**Bhawant Singh**	**Bishen Singh**	**Maya Devi**	**Bhagwati Devi**			**Rekha**	**Sunder Singh**
	18/F/ED/UNMA	35/M/ED-P/MA	23/M/ED-I/MA	25/M/ED-I/UNMA	50/M/UNED/MA	17/F/ED-P/UNMA	30/F/ED/MA			18/F/ED/UNMA	32/M LD/MA
	Geeta	**Munni Devi**	**Deepa Devi**							**Geeta**	**Monika**
	16/F/ED/UNMA	22/F/UNED/MA	20/F/ED-P/MA							16/F/ED/UNMA	27/F/ED/MA
	Kamal Singh										**Ravinder Singh**
	14/M/ED-P/UNMA										30/M/ED/MA
Are you living in this village since birth?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Any member of the family gone out side	NO	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes

the village for Job? If Yes where?	-	Delhi	Dehra Dun	Bang lore	Meerut	-	Delhi	Delhi			Delhi
Work done by Family Members	Agriculture	Agri, Pri Ser.	Agri, & Service	Agri & Service	Agri & Busi.	Agriculture	Agriculture	Agriculture 7 Ser	Agriculture	Agriculture	Agri & Busi.
Water (Time/ Dist./Help taken)	2hr /500m/40 %	3hr /1km/25%	3hr /800m/30%	2hr /500m/-	4hrs/800m/-	3hr./900m/20%	2hr./500m/20%	3hr /700m/20%	2hr./800m/20%	2hr /500m/20%	2hr./600m/20%
Fodder for animals	5hr /4Km /-	4hrs/3km /10%	4hrs/3Km/10%	5hr /2Km /-	5hr/3Km./10%	4hr./3Km./10%	5hr./3Km./20%	4hr./2.5Km /10%	3hr./4Km./10%	4hr /4Km /-	5hr./3Km /10%
Agricultural Practices	4hr/500m/50 %	4hrs/800m /50 %	3hrs/700m./40%	5hr/500m/30%	4hr/800m/50%	4hr/1km/50%	4hr/800m/60%	4hr/800m/50%	4hr/500m/50%	4hr/500m/50%	4hr/500m/40%
Care of Animal	2hr /-/20%	1hrs/100m/-	3hr/-/10%	2hr./-/-	2hr./-/10%	2hr /-/10%	-	2hr./-/-	-	2hr./-/	-
Work at Home	2hr/-/-	2hrs/ - /-	3hr/-/-	2hr/-/-	1hr/-/-	2hr/-/-	1hr/-/-	2hr/-/-	2hr/-/-	2hr/-/-	2hr/-/-
Total Agricultural Land	35nali	3nali	5nali	10nali	10nali	30nali	50nali	25nali	10nali	5nali	10nali
Cereal (Wheat/ Rice / Corn/ Manduwa)(bags)	7/10/1/2bag	/-/-/1/3	1/1/-/2	/5/-/-	2/ 6/ -/-	4/ 8/ - /6bags	7/ 18/-/8bag	4/5/-/4	2/4/- /-	1/-/-/-	4/2/-/-
Pulses(Soyabean/Urd/ Gaut/Rajma) (Kg)	/-/20kg/-	20/15/10/10	/5/10/10	/ 12/ 10/-	/-/ 15/-	/ 20/ 1 bag/ -	/ /2 bags/-	/-/50/-	/-/10/-	/-/10/-	/-/50/-
Number of Animals	4	5	5	4	2	7	-	2	-	7	-
House (Kuccha/pakka)	Pakka	Kuccha	Kuccha	Kuccha	Kuccha	Kuccha	Pakka	Kuccha	Kuccha	Kuccha	Kuccha
Monthly Expenditure (Rs.)	2500	2000	4000	4000	3000	1500	1000	5000	1000	2000	3000
Use of Wood (kg/month)	300	300	240	450	325	150	100	150	300	450	450
For Cooking (Kg/month)	250	250	150	260	275	100	70	120	200	350	400
For prevention from cold (Kg/month)	50	50	90	90	50	50	30	30	100	100	50
Name of the plant used for burning	Chir-Pine	Chir-Pine, Bushes	Chir-Pine	Chir-Pine , Hisalu, Pyrus & Berberis	Chir-Pine & Pyrus	Chir-Pine	Chir-Pine	Chir-Pine, Pyrus	Chir-Pine, Pyrus	Chir-Pine	Chir-Pine
Plants used as Fodder	Grasses & hay	Grasses, Bhimal	Grasses, Bushes	Grasses, Bhimal,	Grasses, Bhimal,	Grasses	-	Grasses	-	Grasses	-

Fodder For Cow /Amount(Kg/month)	Grasses/450	Grasses/540	Grasses/450	Grasses/650	Grasses/550	Grasses/540	-	Grasses/500	-	Grasses/500	-
Fodder for Buffalo/Amount (kg/month)	550	-	-	-	-	-	-	650	-	600	-
Do you send your cattle's for grazing in the forest	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Name of the Head of Family	Kishen Singh	Surender Singh	Nathu Ram	Dev Ram	Ram Lal	Bachhi Ram	Ganga Ram	Govind Ram	Anand Ram	Hari Ram	
Age	39yrs	50yrs	37yrs	60yrs	36yrs	36yrs	75yrs	56yrs	50yrs	50yrs	
Caste (SC/ST)	Hindu (Rajput)	Hindu (Rajput)	SC	SC	SC	SC	SC	SC	SC	SC	
Language Known	Hindi, Kumaun	Hindi, Kumaun	Hindi, Kumaun	Hindi, Kumaun	Hindi, Kumaun	Hindi, Kumaun	Hindi, Kumaun	Hindi, Kumaun	Hindi, Kumaun	Hindi, Kumaun	
Number of Family Members	2	9	6	6	3	5	7	12	6	5	
(Age/M or F/Ed. or UEd./ Ma or Unma)	Kishen Singh	Surender Singh	Nathu Ram	Dev Ram	Ram Lal	Bachhi Ram	Ganga Ram	Govind Ram	Anand Ram	Hari Ram	
	39/M/ED/UNMA	50/M/ED/MA	37/M/ED/MA	60/M/UNED/MA	36/M/UNED/MA	36/M/UNED/MA	75/M/UNED/MA	56/M/UNED/MA	50/M/ED/MA	50/M/UNED/MA	
	Rajeshwari	Jashodha	Lovely Devi	Chandoli Devi	Kamla Devi	Bhagwati	Ravti Devi	Lachhima Devi	Kalawati	Saraswati	
	75/F/UNED/-	45/F/UNED/MA	26/F/UNED/MA	55/F/UNED/MA	30/F/UNED/MA	30/F/UNED/MA	65/F/UNED/MA	52/F/UNED/MA	45/F/UNED/MA	35/F/UNED/MA	
		Ramoti Devi	Girish Lal	Dharma Devi	Khasti Devi	Balwant	Bhim Ram	Jaytuli Devi	Sohan Lal	Parwati	
		65/F/UNED/-	16/MA/ED/UNMA	18/F/ED/MA	65/F/UNED/-	17/M/ED/UNMA	35/M/ED/MA	100/F/UNED/-	22/M/ED/UNMA	18/F/ED/MA	
		Pratap Singh					Nandi Devi	Jagat Ram	Rekha	Ramesh lal	
		25/M/ED/UMMA					26/F/UNED/MA	48/M/UNED/UNMA	18/F/ED/UNMA	22/M/ED/MA	
		Rajender Singh					Bhhuwan Ram	Ramesh Lal	Neema		

		29/M/ED/UNMA					22/M/ED/UNMA	37/M/UNED/MA	16/F/ED/UNMA		
		Pushpa Devi						**Devki Devi**			
		17/F/ED/UNMA						35/F/UNED/MA			
								Basant Lal			
								28/M/ED/MA			
Any member of the family gone out side	Yes	Yes	No	No	No	No	No	No	Yes	No	
the village for Job? If Yes where?	Delhi	Dehra Dun							Delhi		
Work done by Family Members	Agriculture	Agriculture	Agriculture	Agriculture	Agriculture	Agriculture	Agriculture	Agriculture	Agriculture	Agri & labour	
Water (Time/ Dist./Help taken)	3hr./900m/20%	2hr./400m/20%	3hr./1.5km/-	2hr /800m/10%	2hr./900m/30%	3hr./1km/10%	2hr./1km/40%	2hr./900m/-	2hr /100m/30%	2hr./500m/20%	
Fodder for animals	4hr./4Km./10%	4hr./4Km./10%	4hr./4.5Km./-	5hr./4.5Km./10%	4hr./4.5Km./10%	4hr./4.5Km./30%	5hr./5Km./50%	5hr./5Km./10%	5hr./4Km./-	5hr./4Km./-	
Agricultural Practices	3hr/500m/50%	4hr/500m/50%	4hr/1km/30%	4hr/800m/40%	4hr/600m/30%	3hr/500m/40%	4hr/500m/50%	4hr/1km/50%	4hr/500m/30%	-	
Care of Animal	2hr./-/-	2hr./-/30%	2hr./-/-	2hr./-/20%	2hr/-/-	2hr./-/40%	-	2hr./-/-	2hr./-/-	2hr./-/30%	
Work at Home	2hr/-/-	2hr/-/-	2hr/-/-	2hr/-/-	2hr/-/-	2hr/-/-	2hr/-/-	2hr/-/-	2hr/-/-	2hr/-/-	
Total Agricultural Land	37nali	60nali	5 nali	10 nali	35 nali	2 nali	15 nali	32nali	3 nali	-	
Cereal (Wheat/ Rice / Corn/ Manduwa)(bags)	7/5/2/3 bags	9/15/-/3bags	½ bags/-/-	2/ 4bags/-/1bag	7/10/-/5bags	/2/-/-	3 /6 / 1/-	6/10/2bag/-/-	/2/-/-	-	
Pulses (Soyabean/Urd/ Gaut/Rajma) (Kg)	/-/1bags/-	/-/1bags	/-/15kg/-	/-/50kg/-	/-/50kg	/-/10/-	/-/ 50/-	/-/15kg/-	-	-	
Number of Animals	15	19	9	13	8	11	-	6	5	1	

House (Kuccha/pakka)	Kuccha	Pukka	Pukka & Kuccha	Kuchha	Kuchha	Kuchha	Kuccha	Kuccha	Kuccha	Kuccha	
Monthly Expenditure (Rs.)	1000	4000	5000	3500	1500	2000	2000	3000	2500	1500	
Use of Wood (kg/month)	100	450	360	350	150	300	300	450	300	300	
For Cooking (Kg/month)	60	300	300	300	75	250	240	400	240	240	
For prevention from cold (Kg/month)	40	150	60	50	75	50	60	50	60	60	
Name of the plant used for burning	Chir-Pine	Chir-Pine, Pyrus	Chir-Pine	Chir-Pine	Chir-Pine, Pyrus	Chir-Pine	Chir-Pine, Pyrus	Chir-Pine	Chir-Pine	Chir-Pine	
Plants used as Fodder	Grasses	Grasses	Grasses	Grasses	Grasses	Grasses & Hay	-	Grasses & Hay	-	-	
Fodder For Cow /Amount (Kg/month)	Grasses/560	Grasses/480	Grasses/600	Grasses/540	Grasses/540	Grasses/400	-	Grasses/400	-	-	
Fodder for Buffalo/Amount (kg/month)	600	625	-	500	580	540	-	600	-	-	
Do you send your cattle for grazing in the forest	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	

Appendix: 2

ANIMAL HUSBANDRY DATA OF KATARMAL										
Name of the Head of Family	Bhagwant Singh	Divan Singh	Kushal Singh	Bishen Singh	Jaman Singh	Lal Singh	Krishna Devi	Pan Singh	Badri Singh	Gopal Singh
Number of Family Members	7	5	8	3	5	4	3	4	4	7
Adults/Children's	(2/4)	(4/1)	(5/3)	(3/0)	(3/2)	(2/2)	(3/0)	(2/2)	(2/2)	(3/4)
Male/Female	(4/3)	(2/3)	(4/4)	(2/1)	(4/1)	(2/2)	(1/2)	(3/1)	(1/3)	(2/5)
Type and No. of Animals	5	5	5	4	2	9	-	2	-	7
Cattle : Cow/s	3	2	1	1	1	2	-	1		1
Bullocks		2	3	2	-	-	-			2
Bulls		-	-	-	-	-	-			-
Male Calves		1	1	1	1	-	-			1
Female calves		-	-	-		2	-	1		
Female Buffaloes	2						-			1
Male Buffalo							-			
Male Buffalo							-			
Female Buff							-			
Sheep (Adults)							-			
Lambs							-			
Goats(Adults)						5	-			2
Kids							-			
Poultry(Adult/chicken)							-			
Others							-			
For breeding							-			
Do you use natural service or artificial insemination	Natural	Natural	Natural	Natural	Natural	Natural	Natural	Natural	Natural	Natural
Do your animals go for grazing in the forest	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
or they are being stall fed	No	No	No	No	No	No	No	No	No	No
Do you make selage/hay	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Is there a fodder bank located near your village	No	No	No	No	No	No	No	No	No	No

Are you cross breeding your cows	No	No	No	No	No	No	No	No	No	No
Maximum production of milk from a cow (Kg/day)	3	2	2	1.5	1.5	2	-	1.5		2
Maximum production of milk from a buffalo (kg/day)	4.5	-	-	-	-	-	-	-	-	5.5
Are you part of a cooperative for marketing of milk, wool or eggs	No	No	No	No	No	No	No	No	No	No
Monthly/annual income from sail of milk/wool/eggs/goats	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Are you willing to reduce the no. of your animals if a substitute for manure is available	No	No	No	No	No	No	No	No	No	No
Money spent on upkeep of animals (Rupees/month)	30-75	30-76	30-77	30-78	30-79	30-80	30-81	30-82	30-83	30-84
Sharing cost of substitution of non descriptors animals with cross breed animals	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Who accompanies your animals for grazing	Family members	Family members	Family members	Family members	Family members	Family members	Family members	Family members	Family members	Family members
Distance of village from nearest veterinary/ hospital/dispensary/AI centre	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5
Any treatment provided at your door step	No	No	No	No	No	No	No	No	No	No
Regular vaccination	Irregular	Irregular	Irregular	Irregular	Irregular	Irregular	Irregular	Irregular	Irregular	Irregular
Are you satisfied with animal husbandry	No	No	No	No	No	No	No	No	No	No

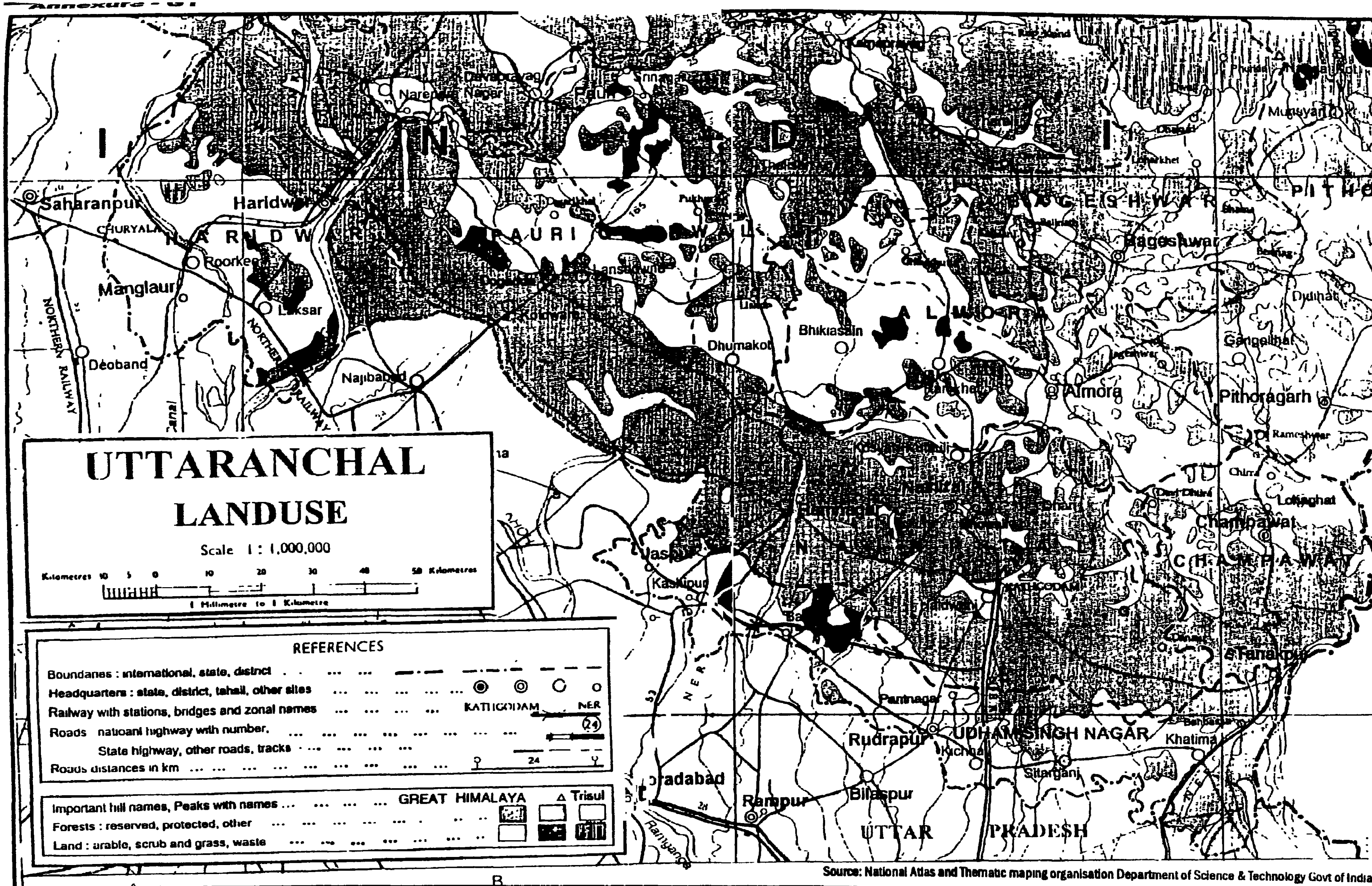
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ANIMAL HUSBANDRY DATA OF KATARMAL

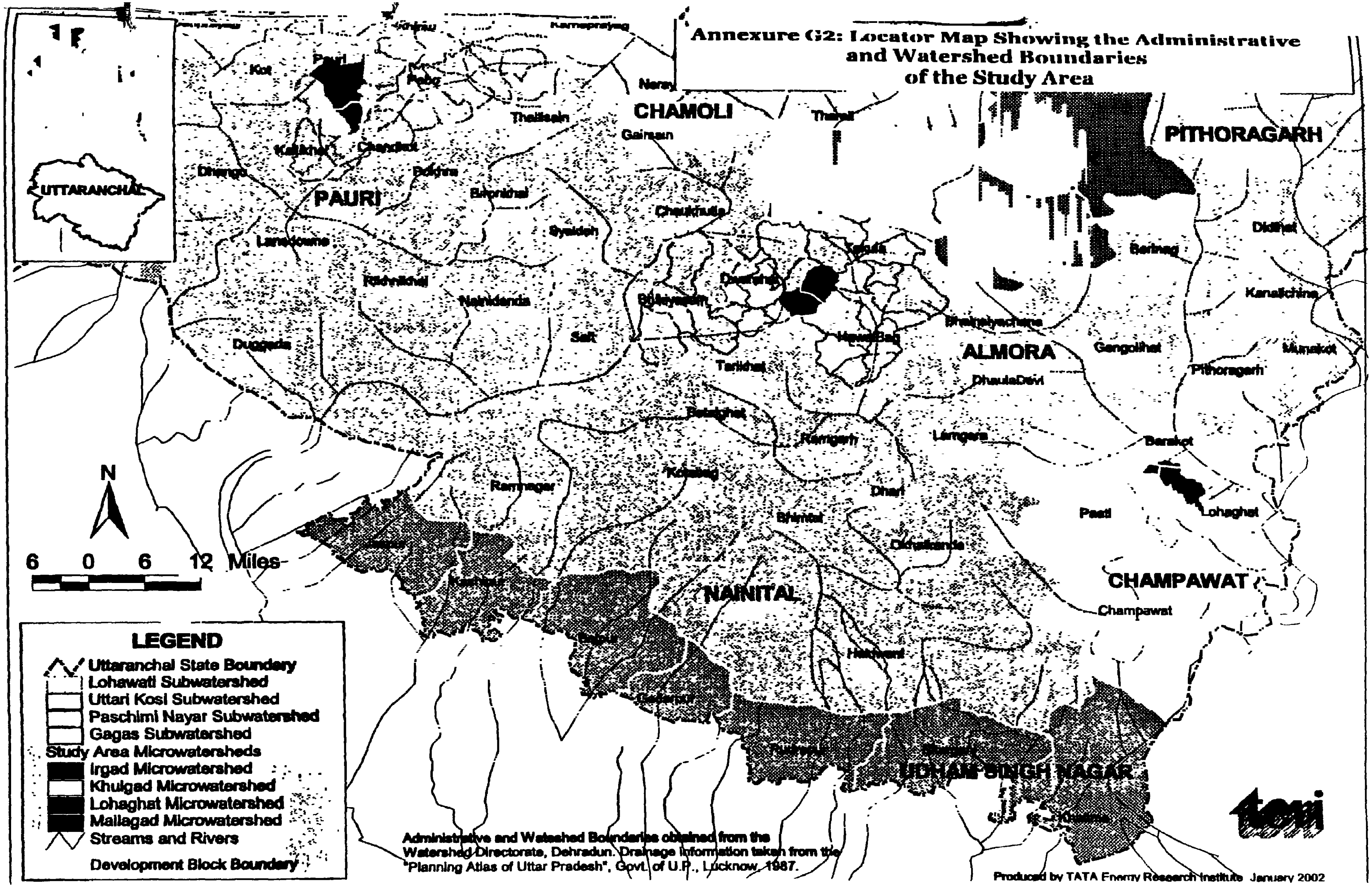
Name of the Head of Family	Kanhiya Singh	Kishen Singh	Surender Singh	Nathu Ram	Dev Ram	Ram Lal	Bachhi Ram	Ganga Ram	Govind Ram	Anand Ram	Hari Ram
Number of Family Members	10	2	9	6	6	3	5	7	12	6	5
Adults/Children's	(6/4)	(2/0)	(5/4)	(2/4)	(3/3)	(3/0)	(3/2)	(5/2)	(8/4)	(4/2)	(4/1)
Male/Female	(5/5)	(1/1)	(3/6)	(3/3)	(3/3)	(1/2)	(3/2)	(4/3)	(7/5)	(3/3)	(3/2)
Type and No. of Animals	-	15	20	9	13	8	11	2	6	5	1
Cattle · Cow/s			1	1	-	-	1		2	1	1
Bullocks			2	2	2	2	2	2	2	2	
Bulls			-			-					
Male Calves									1	2	
Female calves						2					
Female Buffaloes			1	1	2	1	1		1		
Male Buffalo											
Male Buffalo											
Female Buff											
Sheep (Adults)											
Lambs											
Goats(Adults)			5	4	5	3	4				
Kids											
Poultry(Adult/chicken)		15	11	1	4		3				
Others											
For breeding											
Do you use natural service or artificial insemination	Natural	Natural	Natural	Natural	Natural	Natural	Natural	Natural	Natural	Natural	Natural
Do your animals go for grazing in the forest	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
or they are being stall fed	No	No	No	No	No	No	No	No	No	No	No
Do you make selage/hay	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Is there a fodder bank located near your village	No	No	No	No	No	No	No	No	No	No	No

Are you cross breeding your cows	No	No	No	No	No	No	No	No	No	No	No
Maximum production of milk from a cow (Kg/day)			2	1 5	-	-	2		2	1 5	2 5
Maximum production of milk from a buffaloes (kg/day)	-	4	6	-	5	5	6	-	4	-	-
Are you part of a cooperative for marketing of milk, wool or eggs	No	No	No	No	No	No	No	No	No	No	No
Monthly/annual income from sail of milk/wool/eggs/goats	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Are you willing to reduce the no. of your animals if a substitute for manure is available	No	No	No	No	No	No	No	No	No	No	No
Money spent on upkeep of animals (Rupees/month)	30-85	30-86	30-87	30-88	30-89	30-90	30-91	30-92	30-93	30-94	30-95
Sharing cost of substitution of non descriptors animals with cross breed animals	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Who accompanies your animals for grazing	Family members	Family members	Family members	Family members	Family member s	Family members	Family members	Family members	Family member s	Family members	Family members
Distance of village from nearest veterinary/ hospital/dispensary/AI centre	12.5	13.5	14.5	15.5	16.5	17.5	18.5	19.5	20.5	21.5	22.5
Any treatment provided at your door step	No	No	No	No	No	No	No	No	No	No	No
Regular vaccination	Irregular	Irregular	Irregular	Irregular	Irregula r	Irregular	Irregular	Irregular	Irregular	Irregular	Irregular
Are you satisfied with animal husbandry	No	No	No	No	No	No	No	No	No	No	No

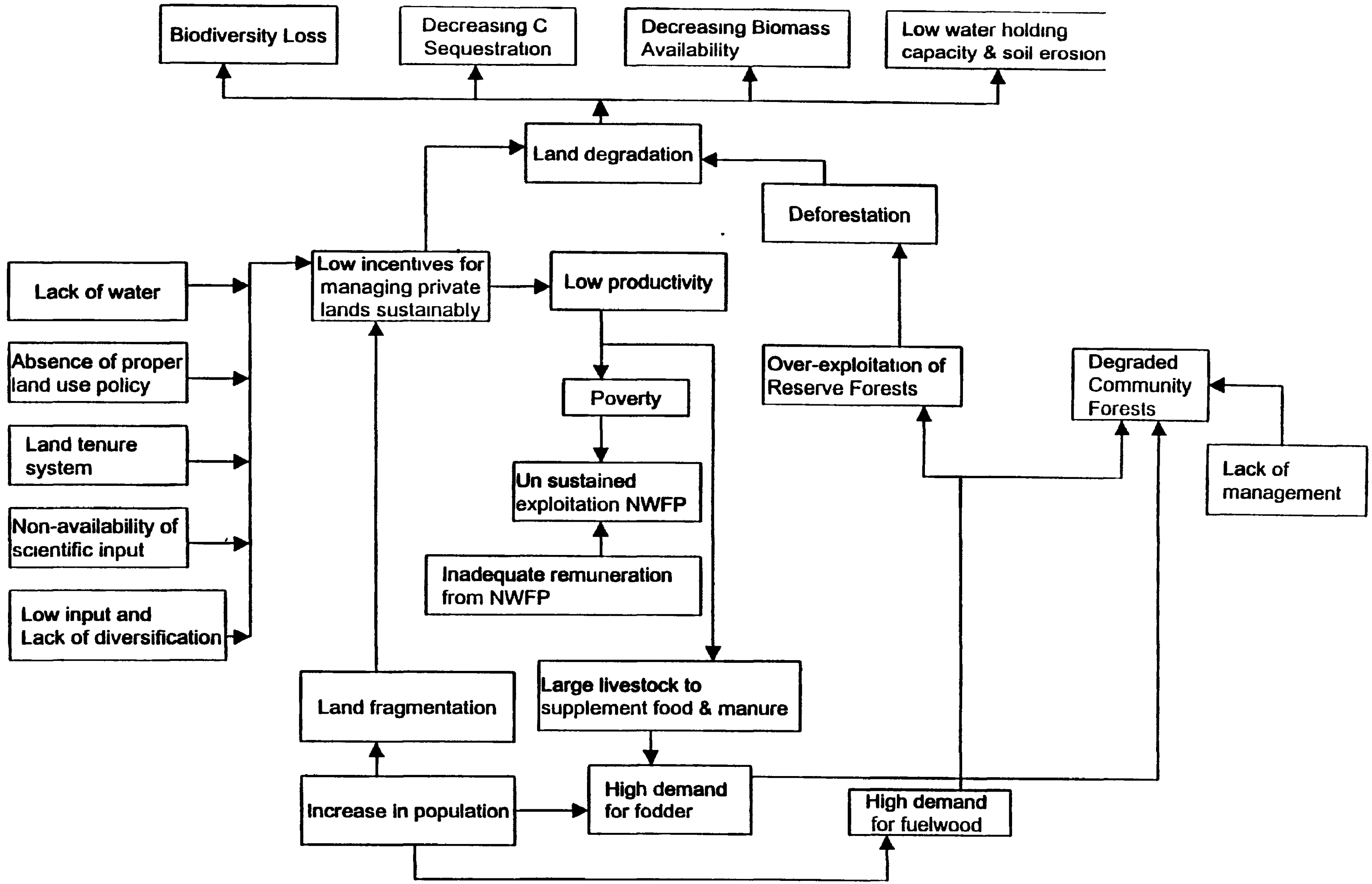
Annexure - 61


UTTARANCHAL
LANDUSE
Scale 1 : 1,000,000
Kilometres 10 5 0 10 20 30 40 50 Kilometres
1 Millimetre to 1 Kilometre
REFERENCES
Boundaries : international, state, district
Headquarters : state, district, tahsil, other sites
Railway with stations, bridges and zonal names
KATHGODAM
NER
Roads national highway with number,
State highway, other roads, tracks
Roads distances in km
24
Important hill names, Peaks with names
GREAT HIMALAYA
Trisul
Forests : reserved, protected, other
Land : arable, scrub and grass, waste
Saharanpur
Haridwar
Roorkee
Manglaur
Laksar
Deoband
Najibabad
NORTHERN RAILWAY
HARIDWAR
PAURI
Lansdowne
Dhumakot
Bhikiasain
Almora
Bageshwar
Pithoragarh
Didihat
Gangolihat
Munsyari
Champawat
Lohaghat
Tanakpur
Khatima
Sitarganj
Kichha
Rudrapur
Pantnagar
Bilaspur
Rampur
Kashipur
UDHAMSINGH NAGAR
CHAMPAWAT
BAGESHWAR
UTTAR
PRADESH
Source: National Atlas and Thematic maping organisation Department of Science & Technology Govt of India

Annexure G2: Locator Map Showing the Administrative and Watershed Boundaries of the Study Area



Annexure H1 - Root Cause Analysis



ANNEXURE H2 - THREATS AND ROOT CAUSES ANALYSIS

Problem	Threats	Root causes	Alternative strategy
Loss of globally significant Himalayan biodiversity Declining Carbon sequestration Declining biomass stock Decreasing water holding capacity and increasing soil erosion	Degradation of private lands	• Low return from managing private lands • Land fragmentation due to population increase • Insufficient intervention for soil, moisture and water conservation • Absence of proper land-use policy • Unfavorable land tenure system • Non-availability of scientific information for agriculture • Low inputs agriculture and lack of diversification	• Strengthening the legal, policy and institutional framework to remove barriers to facilitate adoption of ecologically and economically sustainable land-use practice. • Evolving favourable tenurial arrangement to re-vegetate deserted private lands • Demonstrating economically profitable agro-forestry models on private lands • Demonstrating of soil and moisture conservation techniques • Developing institution and institutional linkage for micro finance • Building technical capacity of local farmers in agro-forestry • Developing innovative tools for information dissemination. • Reducing price spread through establishing forward linkages with institutions for marketing and market information. • Increasing income generation opportunities for women
	Unsustainable harvest of NWFP from the Reserve Forests	• Low income from agriculture • Large price spread • Non-availability of NWFP in community forests	• Increasing supply of NWFP species including medicinal plants from C & S forests. • Promoting cultivation of medicinal plants in private agricultural lands • Developing capacity of the local people for post harvest operations of NWFP • Developing institutions and institutional linkage for micro finance • Reducing price spread through establishing forward linkages for marketing and market information • Developing equitable benefit sharing mechanism for sharing benefits from NWFP • Increasing income generation opportunities for women

Problem	Threats	Root causes	Alternative strategy
	Overexploitation of Reserve Forests for the fodder	• Non-availability of fodder in community forests • Large livestock holdings to supplement the nutritional requirement • Large livestock holdings for manure requirement in agriculture • Lack of facilities for breed improvement • Goat and sheep rearing to supplement income	• Increasing the availability of fodder from C & S forests • Demonstrating improved livestock management models • Improving breed through selective breeding , Artificial Insemination (AI) and better health care services • Training of beneficiaries on technical capabilities including weaving of angora wool and developing products • Training group of local educated unemployed youths as para-veterinarians • Establishing AI Units at the cluster level • Developing institutions and institutional linkage for micro finance • Increasing income generation opportunities for women Increasing opportunity for women for income generation • Developing innovative tools for information dissemination
	Unsustainable removal of fuelwood from Reserve forests	• High demand for fuelwood due to long and harsh winter • High demand for fuelwood due to population increase • Degradation of community forests	• Increasing supply of fuelwood from C & S forests • Increasing supply of fuelwood from agro-forestry intervention.
	Degradation of community forests	• Unsustainable removal of fodder and fuelwood • Unsustainable management of C & S forests • Lack of inter-sectoral co-ordination	• Strengthening the legal, policy and institutional framework to evolve sustainable management of C & S forests • Building upon community institutions for the management of C & S forests • Demonstrating self-financing re-vegetation models based on diverse biomass needs (fuel wood, fodder, NWFP) of local people to reduce pressure on forests • Evolving mechanism for equitable

Problem	Threats	Root causes	Alternative strategy
			benefit sharing arrangements for the distributions of usufructs especially fodder. fuelwood and NWFP. • Evolving the sustainable harvesting method for NWFP, fodder and fuelwood • Training a group of local educated. unemployed youths and NGOs for preparing Microplan for the management of C &S forests

ANNEXURE I – PUBLIC INVOLVEMENT

Stakeholders' involvement has been given utmost importance in the PDF B process of project formulation as also in the proposed structure of implementation. The PDF B process was undertaken for six months between September and December 2001 with the financial assistance from UNDP. In the PDF B process participation of stakeholders was assured through (i) organizing consultative workshops at the state and regional levels involving government officials, village leaders, women's groups, scientists and social scientists of universities and research institutes and local NGOs (Minutes of the Workshops); and (ii) PRA exercises at 60 villages spread over four selected project sites involving more than 1000 village men and women to gather information on current ecological and socio-economic information, constraints for biodiversity conservation and also way out to regenerate biomass base and conserve biodiversity of the area. Other than group discussions Social mapping, Seasonal calendar, Ranking and other PRA techniques were involved to gather information (Annex G PRA maps).

As decided in the project initiation workshop, basic unit for demonstrating integrated IVAE management will be watershed. Subsequently, the four areas for demonstration were identified in the workshops organized in two regions, Garhwal and Kumaon, which cover Irgad micro-watershed in Pauri Garhwal district in Garhwal Himalayas, Mallaya micro-watershed and Kosi sub-watershed in Almora district in central Kumaon and Lohawati micro-watershed in Champawat district at the border of India and Nepal.

During the project implementation Stakeholders will be fully involved in the planning, development and management of IVAE management including management of civil and soyam lands through:

- Encouraging individuals and community initiatives by strengthening the technical and management capacities;
- Promoting indigenous knowledge
- Income generation through agro-forestry, mediculture, livestock and also promoting self-help groups for women
- Promoting improved control of the local institutions by the end-users by ensuring their training in planning, monitoring, and evaluation of measures for the sustainable VAE management.

Project beneficiaries

The benefits will consist of training, capacity building, participatory management, development marketing arrangement and equitable redistribution of wealth and services that accrue from sustainable use/management of IVAE management. The project beneficiaries will mainly include poor rural families especially women, who depend on biomass resources for their survival, development departments and local NGOs. Overall, project will reach out a total of 56 villages and 10,000 people.

The families living in the countryside in Uttaranchal will be the primary beneficiaries of this project. They are mostly poor (an estimated 36% families of Uttaranchal hills fall under BPL category), without having access to either technical information or managerial capacity and market to utilize the lands sustainably. Women are the worst sufferers as they bear most of the burden of this situation. Thus, the project, for this group, will on the one hand try to bring

reforms in the legal and policy environment to hand over the management responsibility and user rights of the civil and soyam lands. On the other side, project will try to build the management and technical capacity of the community for the sustainable utilization of civil and soyam lands. The project will foster the better utilization of their agricultural lands by promoting agro-forestry including mediculture and livestock intervention. The project will try to develop better marketing network by establishing forward and backward linkages, which will help bringing better returns from the land and non-land based income generation activities.

Women will be the primary focus for all these interventions. Self Help Group as a group will be used as a platform to extend credit to the individual members as per the norms evolved by the group. Members would be generally oriented to use it for the productive purposes, e.g. Agro-forestry, Animal Husbandry and for other non-farm based enterprises that can help them to increase their income levels. Since access to financial services will not be enough for them to transform their economic activities into profitable enterprises, SHGs would also be used as a channel for various support services, like access to markets, information technical know-how etc. to make their enterprises competitive in the market.

Local educated unemployed youths (including women) will be the third group of beneficiaries. They will be trained as para-vets for providing health facilities to livestock. This will, on the one side, provide the health and other day-to-day facilities for livestock development at the doorstep of the village community, on the other hand, will provide local youths (including women) the opportunity for income generation.

Local NGOs will be the other group of beneficiaries. They will be given training on various technical aspects related to VAE management and development such as Microplanning, information sourcing for agro-forestry and livestock. Selected individuals from NGOs will be trained as Training of Trainers (TOTs) who will help sustaining and replicating the project in other areas of the region.

ANNEXURE J1 – IMPLEMENTATION ARRANGEMENT

Uttaranchal Forest Deaprtment (UFD) will be the principal coordinating agency for the project implementation. Figure provides a sketch of the entire institutional structure stretching at four levels - state, region, district and village. At the state level, the apex body will be the Steering Committee, headed by Principal Secretary, Forests and Rural Development Commissioner and the Principal Chief Conservator of Forests (PCCF) as the Co-Chairman. In addition to Forest, other relevant development departments like Planning, Rural Development, Horticulture, Animal Husbandry & Fishery, Agriculture; and Panchayati Raj Development Cooperation will be represented by respective Additional Secretaries to ensure the coordination and integration between departments for optimum utilization of finance. manpower and other resources available under ongoing schemes. The Committee will have representatives from important institutions of Uttaranchal related to research and technology development as Co-opted Members to establish strong backward and forward linkages between *land and lab*. The Steering Committee will be responsible for the overall guidance and policy decision for the project.

The Chief Project Director, an officer of the rank of Chief Conservator of Forests, will be responsible for coordinating the implementation of the entire project. Project Director posted at two regions namely Garhwal and Kumaon will be working as the vital link between Chief Project Director and Deputy Project Director(s). The Office of the Deputy Project Director (at the concerned Division level) headed by the Deputy Conservator of Forests will be responsible for implementing the project guidelines at the field.

The project will be implemented at the village level through the Village Level Committee (VLC). The General Body of the VLC will include representatives (male and female) from all families who will be influenced by the proposed intervention. The Executive Committee comprising of representatives from each class, caste and interest groups; and hamlet of the village will be responsible for the day-to-day activities of the project. At least one third of the members shall essentially be women. Panchayat representative will also be included in the committee for coordinating with existing administrative set-up and avoid duplication. Additionally, self-help group(s) and thrift and credit group(s) for women will be formed for implementing some of the project interventions.

Monitoring Committee formed at the Block Level will include Range Officer, local NGO(s), VLC representative(s) by rotation and the committee will be working closely with the VLC and will periodically review all activities to ensure the smooth and systematic implementation. At least one third of the members will be women.

Advisory Committee will be formed at two levels. The Project Advisory Committee formed at the State level will be primarily interacting with the Chief Project Director and regional Project Director. This Committee will comprise of experts from various fields and professionals from NGO, Medicinal Plant Board as also industries and is expected to provide guidance for establishing forward and backward linkages at the post harvesting operation in particular (including processing and marketing) for getting maximum benefits from the project intervention. Advisory Committee at the district level, headed by the concerned District Magistrate will provide guidance at the district level.

The institutional design for project implementation has following strengths:

- Providing a common platform for relevant line departments for collective action and avoid duplication.
- Close interaction with local scientific and technical experts and organizations to utilize all available resources.
- Ensure beneficiary participation including women at all levels of implementation, in designing, implementation and monitoring.

Letter of endorsement from Uttaranchal Government for organizational structure for project implementation

उत्तरांचल शासन

Dr.R.S. TOLIA
Principal Secretary &Commissionor

Forest & Rural DevelopmentCommissionor
No. 1917/1-F&R.D/2002
Debra dun : 27 March, 2002

Sub:- Carbon sequestration and biodiversity conservation in Uttaranchal hills by holistic initiatives in village agro-ecosystems.

Dear Sh. Satya Narain,

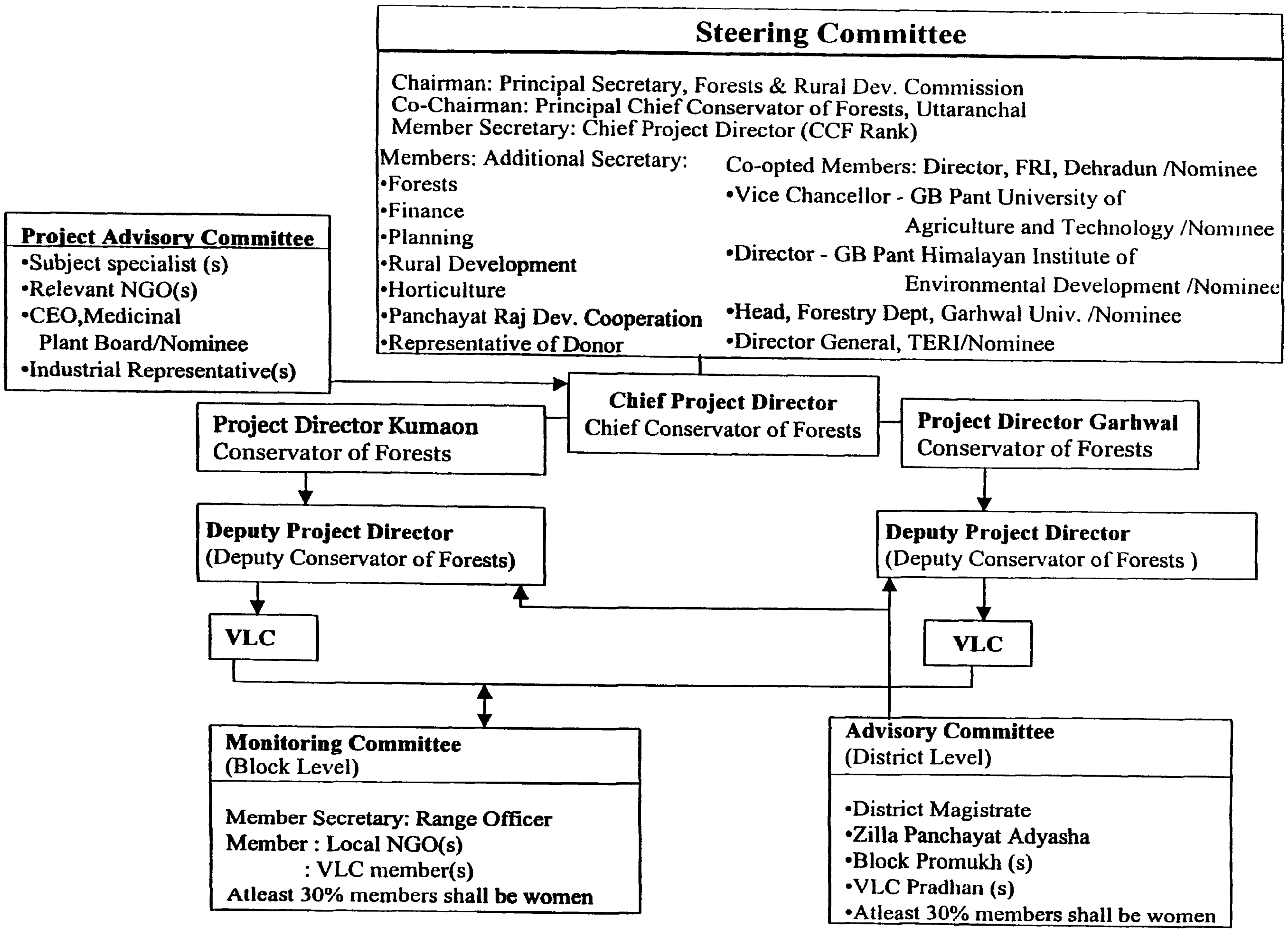
I understand that FRI Dehradun & TERI New Delhi have developed a project proposal " **Carbon sequestration and biodiversity conservation in Uttaranchal hills by holistic initiatives in village agro-ecosystems**". The Govt. of Uttaranchal endroses the proposed organiational structure for implementation of project as mentioned in the project document. In the eventuality of its funding from UNDP-GEF, the state goverment will constitute these committees.

With regards,

(Dr.R.S. TOLIA)
Principal Secretary &Commissionor

Sh. M.Satya Narain,
Focal Person,
GEF Cell,
Ministry of Environment & Forests,
Govt. of India,
CGO Complex, Lodi Road,
New Delhi.

Annexure J2 - Organizational Structure for Project Implementation



Annexure K - TECHNICAL SPECIFICATION AND STRATEGIES

The activities identified for the alternative GEF scenario in consultation with local, state and national stakeholders and based on the lessons learnt in the baseline experience is aimed at removing the obstacles to IVAE development. The proposed interventions will also ensure the sustainability of the measures implemented and their success into the post-project phase. The technical interventions suggested in the proposal though are field tested, however, the approach of adaptive management will be practiced to adjust to the requirements of the fields from time to time.

1. Legal and policy issues

The supportive legal structure and conducive policy environment will be prerequisite for the success of IVAE management. The baseline scenario on legal and policy status has shown number of gaps and constraints towards developing integrated VAE management aiming at biodiversity conservation, C sequestration and fulfilling the requirements of local. Hence, it is proposed to take up a review of the legal and policy frameworks related to agro-forestry and management of Civil and Soyam lands to suggest necessary amendment for adapting effective VAE management with popular participation. In addition, once present obstacles will be identified, advocacy campaign will be undertaken to educate the stakeholders especially the government representatives about it.

2. Capacity building

Capacity building and institutional strengthening constitute the core of the project. Discussions during the PDF B process revealed that the lack of technical and managerial capacity of stakeholders is the primary constraint to sustainability of any intervention. The participation of local community has been emphasized for project implementation. However, locals who are neither technically trained nor have the resources to hire an expert to facilitate the preparation of various development plans (such as Microplan) which will be the guide for the entire intervention. Therefore, capacity building programmes will educate the people on technical prescriptions, mechanism for utilization of income from sale proceeds and information sourcing for agro-forestry interventions, marketing of products etc.

In order to achieve the objectives of sustainable use of the degraded civil soyam forests areas, one of the most important requirement is to strengthen the technical capacity of the people. Since the whole economy of these areas is biomass based, the process of raising the technical potential will focus on field education and hands on training for raising nurseries, plantation, the silvicultural operations, harvesting strategies, post harvest technology, efficient logging etc. There is an essential need to educate and train people at various stages through the help of the institutions in the area, through visits to developed areas and through learning-by-doing. There will also be a need to

monitor the effectiveness of the intervention for necessary course correction during the project implementation.

3. Self Help Groups

The activities that have been suggested for generating alternative incomes will need initial capitalization to take off and become financially sustainable. However, lessons learnt during the PDF B process has shown that in the project areas large majorities of people do not have adequate investments to get an income that can generate any savings. Without any savings, there is no capital formation and thus there is no further investment for any new initiative for income generation. The only way poor can break out of this cycle is to infuse some capital for increasing investment in form of credit. Significance of credit becomes all the more important in a poor economy like that in Uttaranchal that relies heavily on the external sources.

Micro-Credit studies over the last decade have shown that easy access to reliable and convenient financial services prove to be a much better tool in eradicating poverty through gainful work, particularly self employment. Success of the concept of Self-Help groups (SHGs) and their large scale adoption as an instrument of rural development has shown that poor people, particularly women can put savings and credit services to good use, in building their assets, income, skills and confidence.

SHG as a group can be used as a platform to extend credit to the individual members as per the norms evolved by the group. Savings of the group can be supplemented by external funds by connecting them with the regional rural banks/ govt. schemes operating with the same mandate. Though the group would not get involved in the financial decision making of the borrowers, members would be generally oriented to use it for the productive purposes, e.g. Agro-forestry, Animal Husbandry and for other non farm based enterprises that can help them to increase their income levels. Since access to financial services will not be enough for them to transform their economic activities into profitable enterprises, SHGs would also be used as a channel for various support services, like access to markets, information technical know-how etc. to make their enterprises competitive in the market.

4. Demonstration of technical packages for IVAE on private lands and civil and soyam forests and for livestock improvement

- Private lands and agro-forestry

It is proposed that in the GEF scenario agro-forestry models will focus on introduction of indigenous tree species known to have potential for production of fodder and augmentation of soil fertility by the process of litter and root turn over. Locals will be trained on the aspects of seed collection, raising of seedlings and nurseries, plantation techniques and upkeep of trees. The training on the aspects of harvesting and post harvesting methods to add value to the produce will also be imparted. There will also be a

provision to educate villagers on the aspects of regulations dealing with harvest, transit and sale of the products.

Agro-forestry will be undertaken on private land on which they are not doing anything due to various reasons. In this activity people will be supplied with the plants and the technical know-how and they will do the rest activity.

Plantation of timber species: 1100 plants will be planted in one ha. 10% plants more will be supplied to meet the initial mortality if any.

Plantation of medicinal plants: Individuals will be motivated to plant medicinal plants in their land. This will be done in 5 ha area/village. 2000 plants will be planted in one ha.

Plantation of horticultural species: Farmers will be motivated to plant horticultural spp. In their farms so that they can supplement their food at the same they also earn some money also. They will be given 250 seedlings of high yielding varies on a per hectare basis.

- Intervention on civil and soyam lands

These are lands with forest cover but under control of the Revenue Department. Local people enjoy certain rights like grazing, fuelwood, fodder and small timber collection over these lands. Due to excessive biotic pressure, these lands are in state of severe degradation. A three tier forestry approach is proposed for such areas in which top canopy will be of tree species, middle canopy will have fodder and medicinal trees/shrubs and the ground flora will be medicinal plants, fodder, grasses and legumes. This approach will be suitably modified in view of the local factors, wherever necessary.

Afforestation work will be initiated by surveying and demarcating the area. Local community will be involved in protection of plants against grazing, fire etc and they may be paid for the work. On the onset of monsoon 1100 plants per hectare will be planted. For planting of medicinal plants and shrubs, the area may be leveled or terraced as per field conditions. As compared to tree species, medicinal plants and shrubs require more intensive maintenance works.

Under Silvipastoral system, the area is divided into smaller blocks and leveling and terracing are carried out.Contour furrows of the size 0.30× .30× 3.0 m are dug and grass seeds are sown on the upper side before the rainy season. Maximum 500 fodder trees per ha are planted. Fencing will be provided in the area.
Following grasses may be taken up for the planting:
Plantation of Bamboo: Bamboo plantation can be taken up as pure or mixed plantation. Areas with good soil depth should be selected for Bamboo planting. Valley areas and lower reaches of Hills may be suitable site for the Bamboo planting at a rate of 500 plants per hectare. Plantations will be maintained by the community regularly throughout the life span of the plantation.

- Prospects of cultivation of medicinal and aromatic plants in uttaranchal

There is hardly any plant of medicinal and aromatic importance (MAP) which is under commercial cultivation in Uttaranchal. Even the plants successfully grown in the past have been abandoned. The examples of *Saussurea costus*, introduced in Bhuna nursery near Chamoli, in 1932 but abandoned just after independence; Saffron grown at Tarikhet during 1979-80 and left uncared for afterwords; *Podophyllum hexandrum* successfully raised at Chakrata by FRI Dehradun and number of exotics such as digitalis, pyrethrum, belladonna and lavender introduced at Chaubatia in Ranikhet and later leftout can be mentioned in this regards.

In recent year, *Jaribooti Shodh Evam Vikas Sansthan*, established with great fanfair in 1993 at Gopeshwar did not take off, A number of high altitude nurseries were opened by U.P. State Forest Department in certain places and various high altitude plants, uprooted from their habitat, were transplanted. All of these met with untimely death due to want of after care. The specific example are the forest nurseries at Nankachori and Mandal in Kedarnath forest range. The work on domestication of many high altitude and endangered plants has been going on at a number of places more prominently in H.N.B. University, Srinagar (Garhwal), G.B. Pant Institute of Himalayan Development, Almora, Central Council of Research in and Ayurveda and Siddha Tarikhet; NBPGR unit at Bhowali and at the level of some non-government organisations but nothing tangible has comeout. The claims made for successful domestication remained unsubstantiated for want of data on the performance of domesticated plants under large scale cultivation. A few plants cultural technologies for which have already been standardised at various centres in the Country have been introduced by some enterprising farmers in the region but result on their performance as commercial crop are still awaited. A number of MAPs for which agro-technologies are available are under large scale cultivation in nearby hill states and which can be successfully grown under identical conditions in Uttarnachal have not been tried. These are Eucalypts, german chamomile, *Tagets minuta*, and European olive under commercial cultivation in Himachal Pradesh and Lavender, Pyrethrum hops and lemongrass in Jammu & Kashmir.

The role of NGOs (Non Government Organisations) and some leading drug & Pharmaceutical Companies of India is also questionable. Uttaranhcal is dotted with a large number of NGOs who have put up claims of successful cultivation of many medicinal and aromatic plants, including those which could not be domesticated yet even by leading research and development organisation. A critical examination of reports submitted by them reveal that such claims, in majority of cases, are just an eyewash to justify the use of funds doled to them by various national and international agencies. Similarly the Drug and Pharmaceutical Companies have established field stations and research centres in various part of Uttaranchal, but their main aim is to get the raw material, procure propagules or study domestication parameters and once these objectives were fulfilled the companies wash off their hands from all their activity. The case of Podophyllum in Kashmir and *Asparagus racemosus*, *Coleus forskoholi* and *Taxus baccata* sub. sp. *Wallichiana* in Garhwal and Kumaon are the glaring examples. (*The author of this document has been a consultant for DST, New Delhi CCRAS, New Delhi &*

GBPIHD, Almora and some international funding agencies and has been personally involved in certain enquiries.)

The local farmers and tribals residing in high altitude areas on the other hand have shown remarkable enterpreaunership in this area. Successful cultivation of *Allium stracheyi, Carum carvi* and *Angelica glauca* by Bhutia tribals in Mana, Niti and biosphere reserve area of Nanda Devi; and cultivation of *Asparagus racemosus* and *Tinospora cordifolia* by the farmers living at lower altitudes appears as silverlining in a otherwise dark area.

There is a great scope for making Uttaranchal a major supplier of medicinal and aromatic plant raw materials. The need is to make a proper assessment of resources, facilities and capabilities. This state is fortunate to have a number of leading Research Institutes such as FRI, High Altitude Research Laboratories at Srinagar. G.B. Pant Institute, Almora and CIMAP centre at Pantnagar who are well equipped to undertake the required work. There is, however, a great need of proper planning, co-ordination between various agencies and identification of target groups. These efforts will need a indepth study relating to the choice of plants to be cultivated; the areas where these could be grown and human resources to be tapped. The work being carriedout on domestication and large scale cultivation has to be speededup. Each success in domistication has to be followed by actual field trials for a minimum period of three years to standardize various agronomical, harvest and post harvest technologies and working out economics. A plant for large scale cultivation can be transferred to the farmer only after an appropriate technology is perfected.

Selection of plant to be cultivated in the state is most important. At present suggestions are made to cultivate all sort of aromatic plants without examination of their ability to perform well, their requirement in the trade and marketability specially vis-à-vis the materials collected from forests. Following is a list of plants proposed for cultivation in Uttaranchal. The basis of selection of these plants is :

1. The plant is naturally distributed in the area.

2. It is suitable for cultivation under existing climate, soil, hydrological and other site conditions.

3. Technologies for cultivation, harvesting and post harvest handling have been developed, and are adaptable by the local growers.

4. There is a regular and sustained demand, good marketability and fair monetary returns.

5. The raw materials, produced can be locally converted to value added products to generate employment avenues and higher monitory returns.

6. The plant to be undertaken for cultivation is not under large scale production elsewhere in the Country from where total requirement of the commodity is metwith. For example, Ashwagandha, Senna, *Dioscorea deltoidea, Gloriosa*

superba, aloe, belladonna, Vinca Kuth, Pushkarmool, Majeeth and Isabgol are under large scale production elsewhere in the country and meeting almost whole of the raw material requirements of the Industry and exporters . There will be marketing difficulties if these are grown in Uttaranchal also.

7. A number of exotics at present imported partially of wholly, are suitable for cultivation under agro-climatic conditions in various parts of Uttaranchal. These need to be introduced in the region. These are *Glycyrrhiza glabra* (source of Mulethi), *Ginkgo biloba, saffron, Carum, carvi, Rose geranium, Bulgarian rose, German chamomile, Eucalyptus macrohynca and Olea europea* (European olive).

8. Some plants growing in the wild are difficult to cultivate. Studies on the domestication and cultivation are still continuing. These have been included in the list but their cultivation should be taken up only after a thorough study and repeated cultural trials. These are *Picrorhiza kurroa, Dactylorrhiza hatagirea, Taxus buccata* sub sps. *wallichiana,* and various species of *Aconitum.*

LIST OF MAP SUITABLE FOR CULTIVATION IN UTTARANCHAL

A. Important and largely traded MAPs occurring naturally

S.No.	Botanical Name (Trade name)	Forest type & site
1.	*Aconitum heterophyllum (Atis)*	Upper fir-moru forest and sub-alpine scrub forests. (2800-3300 m a.s.l.)
2.	*Acorus calamus (Ghorbach)*	Rice fields on old riverine terraces; swampy depressions and along hill streams (300 to 1600 m a.s.l.)
3.	*Angelica glauca (Choora)*	Mixed conifer.forests and nearby broad leaf scrub in moist depressions (2000 to 3000 m. a.s.l.)
4.	*Allium stracheyi (Faran)*	Dry alpine scrub in trans Himalayan valley in Mana, Niti and other places (3300 - 4000 m. a.s.l.)
5.	*Asparagus racemosus (Satavar)*	Lower Oak forests; secondary scrub; border of cultivated fields. (upto 1350 m. a.s.l.)
6.	*Amomum subulatum (Bari Ilayechi)*	Under broadleaf secondary forests and shady grooves in cult. tract. (800 to 1700 m.a.s.l.)
7.	*Aegle marmelos (Belgiri)*	Mixed deciduous & Sal forests and cult. tract throughout up to 1000 m (a.s.l.)
8.	*Berberis asiatica (Daru Haldi)*	In and around chir forests and scrub forests on degraded land (800 to 1200 m.a.s.l.)
9.	*Carum carvi (Caraway)*	Dry alpine valleys in trans Himalayan zone. (350-4000m)
10.	*Celastrus paniculatus Malkangam*	Dry deciduous scrub, border of cultivated fields (1500 to 1000 m a.s.l.)
11.	*Centella asiatica (Brahmi)*	Moist shady places throughout up to

S.No.	Botanical Name (Trade name)	Forest type & site
		1500 m.a.s.l.
12.	*Cinnamomum camphora (kapur patti)*	Sub- tropical scrub forests up to 1000 m.a.s.l. Tea gardens and orchards
13.	*Cinnamomum tamala (Tejpat)*	In revines, Banjh- broadleaf forest; also balnks of streams and rivers (3000 to 3500 m. a.s.l.)
14.	*Dactylorrhiza hatagiria (Salampanja)*	Along moist depressions around snow streams (3000 to 3500 m.a.s.l.)
15.	*Emblica officinalis (Aamla)*	Dry deciduous scrub, riverine scrub at 300 to 1000 m.a.s.l., Caltivaled tract.
16.	*Hedychium spicatum (Kapurkachri)*	On the border of terraced rice fields, and ravines and banks of streams, (1000 to 1500 m.a.s.l.)
17.	*Mucuna pruriens (Kaunch)*	In scrub forests, degraded riverine forests and around cultivated fields (300 to 1200 m. a.s.l.)
18.	*Nardostachys grandiflora (Balchar)*	In bugyals, around sub-slpine scrub and open places in upper fir- kharshu forests. (300-3500 m.a.s.l.)
19.	*Ocimum gratissimum (Laung Tulsi)*	In cultivated tract of Bhabhar and Terai on marginal land at 300 to 500 m. (a.s.l.)
20.	*Picrorrhiza kurroa (Kutki)*	In sub- alpine scrub and grassland around 3500 m. (a.s.l.)
21.	*Piper longum (Chotapipal)*	In mixed deciduous forests under moist and shady conditions 700 to 1200 m.a.s.l.
22.	*Plumbago zeylanica (Chitrak)*	In forest margins of mixed deciduous and Sal forests, riverine forests and scrub (350 to 1250 m.a.s.l.)
23.	*Podohyllum hexandrum (Bankakri)*	Under Fir- Kharshu forests and ravines in mixed conifer forests, 2500

S.No.	Botanical Name (Trade name)	Forest type & site
		to 3300 m. (a.s.l.)
24.	*Rauvolfia serpentina (Sarpagandha)*	In ravines, swampy places in Terai and blanks around Sal forests 300 to 800 m (a.s.l.)
25.	*Rheum australe (Dolu)*	Alpine scrub, specially in dry alpine valley (3000 to 4000 m.a.s.l.)
26.	*Swertia chirayita (Chirayita)*	On open grass slpes, cultivated tracte and terraces on the banks of streams and rivers (2000- 3000 m.a.s.l.)
27.	*Valeriana jatamansi (Tagar)*	On borders of cultivated fields outside forests and scrub on flat land, 1250 to 2000 m. (a.s.l.)

5. Soil and water conservation

The strategy for soil and moisture conservation in the mountain areas needs to be fairly comprehensive and based on measures for a range of slopes starting from level lands to highly precipitous slopes. The soil conservation is an essential pre-requisite for any intervention to be introduced in these areas for sustainable benefits to the dependent communities. Since mountain economy is inextricably related to biomass productivity, the success of establishment of vegetation under different land uses is only assured when we have proper soil conservation measures. The standard strategies for soil and moisture conservation are well defined in the soil conservation manuals and are used the world over. The major intervention for civil and soyam forests under GEF scenario comprises of demonstrating appropriate silvo-pastoral models based on trees and associated grass species and introduction of bamboos and medicinal plants. Therefore, soil and moisture conservation measures to enhance moisture regime shall be integrated with the planting of appropriate species under these models. Moreover, in the pure silvo-pastoral intervention, grasses will play the role of soil and moisture conservation. For replication of the model elsewhere the program of soil and moisture conservation requires training and development of right skills amongst the people specific to the area and slope. The role of endogenic process of decision making is based on technical capability of the villagers. Other Soil and water conservation measures will include making of small check dams, gully plugging, terracing etc but since it is site specific no physical target is fixed but 20% of plantation cost should be given for these works, which should also include maintenance cost.

6. Demonstration of Improved Livestock Management

Livestock in Uttranchal constitutes a very important component of the rural economy as more than 80% of the rural populace are dependant on agriculture, animal husbandry and use of forest land for livelihood. However the scope for effectively utilizing the vast livestock wealth in the state in the State is constrained by low genetic potential, inadequate nutrition, poor health and inefficient livestock management practices.

The primary goal would be the development of sustainable livestock production integrated with carbon sequestration and biodiversity conservation in selected areas of Uttranchal hills. The objectives of the intervention in the livestock component are to:

Develop the existing livestock wealth through:

a) Improving genetic potential
b) Providing better animal health services and nutrition ; and
c) Strengthening livestock sector management and extension.

Attempt will be made to achieve these through following strategies:

CONTROL OF LIVESTOCK POPULATION

Every living animal, whether productive or unproductive, requires a minimum amount of feed for survival which is known as *Maintenance Ration*. The productive animals require, in addition, *Production Ration* proportionate to the amount of milk, meat or wool produced by them. In Uttaranchal, under the current livestock scenario, the maintenance ration of the large unproductive livestock population depletes the total feed & fodder available, hence leaving less resource for the productive animals. This unhealthy competition between the productive and unproductive animals is the root cause of insufficient feed & fodder resources, which leads to net low productivity in spite of large livestock population. To compensate for the low productivity of individual animals, the farmers resort to rearing larger herds resulting in further aggravating the fodder shortages. Effective steps therefore are expedient to reduce the livestock population.

BREED IMPROVEMENT PROGRAMME

The breed improvement programme will be implemented through Artificial Insemination (AI) and natural mating. The breed improvement programme would focus on the development of a stabilized Jersey x indigenous animal; superior cross- bred stock will be identified having 50% exotic genes. *Murrah* bulls will be used to upgrade indigenous buffalo.

- Artificial Insemination (AI)

It is proposed to provide this service at the farmer's door-step by inseminating farmer's non- descript animals with frozen semen of superior quality bulls (Jersey/ indigenous) so that the cross–bred progeny has improved genetic potential of producing more milk while retaining increased resistance to disease as compared to the exotic Jersey animals. For

this purpose it is proposed to set up one Para-vet unit to cover an area of about 5-10 villages with about 1250 breedable bovines. An educated unemployed local youth would be suitably trained for 4 months. Trained Para-vets would operate from their own or rented premises in or around their places of residence under the guidance and supervision of the veterinarians of the Department of Animal Husbandry and Fisheries (DAHF). Para-vets will go to villages with a container of semen and inseminate the eligible animals. The Para-vet will also castrate the scrub male calves to prevent increase in population of unproductive animals; vaccinate the animals and advise the farmers on forage production and management. The self-employed youths would be paid for the initial two years a subsistence stipend to establish them in the command area of 5-10 villages.

- Natural mating

With all the efforts of providing the AI services, it will be difficult to cover the remote villages, hilly and communication starved areas. Hence natural breeding will be necessary to cover these areas. Progressive farmers would be trained in the maintenance of breeding bulls; this would also generate employment for the self-employed youth. These bulls will include crossbred, indigenous breed cattle and *Murrah* buffaloes.

FODDER DEVELOPMENT PROGRAMME

Proper feeding of milch animals has yet to receive the desired attention. A major population of milch animals is suffering from malnutrition due to non-availability of green/dry fodder in adequate quantities all through the year. Forage seed supply is a major constraint to the forage production programmes. A fodder seed mini-kit of improved high yielding varieties will be distributed to the farmers.

- Fodder Development Strategies

This would include:

- ✓ Intensive use of forage trees –"Kisan Van Yojna"
- ✓ Forage development on waste and revenue lands
- ✓ Forage on soil conservation structures
- ✓ Cultivation of high yielding varieties
- ✓ Cultivation of dual purpose crops
- ✓ Fodder conservation and crop residues

Intensive use of forage trees – "Kisan Van Yojna"

Fodder trees would be used widely, primarily for high forage yield and with additional benefits as erosion control, live fences and provision of fuel wood. The farmers would be encouraged to grow leguminous fodder trees in non-agricultural/wasteland/ saline land for the purpose of fodder-cum-fuel plantation.

Wherever possible, fodder trees would be established by direct seeding. Alternatively, farmers would be trained to grow seedlings in small plots and transplant them. Each "Nyaya Panchayat" will have 2 ha of "Kisan Van". Once established, after a

period of 5 years, about 2 tonnes of fodder would be available each year per hectare, besides 2.4 tonnes of fuelwood after 10 years.

Forage development on waste and revenue lands

There are waste and revenue lands, which are overgrazed and have rapidly eroding soils. These lands could be developed for forage production. The project would support the establishment of fodder cooperatives amongst the small farmers and the weaker sections of the society. The available land would be sown with leguminous fodder trees in widely spaced rows with an understorey of legumes and improved grasses on the modules recommended by the Indian Grassland and Forage Research Institute (IGFRI), Jhansi. No incremental resources are required since this programme could be linked with the "Kisan Van Yojna".

Fodder conservation and crop residue treatment

Hay making and plastic bag ensilage would be promoted by the project. Wheat/ paddy straw is available in large quantities and forms the major source of daily ration. The nutritive value of the straw can be improved by treating it with 4% urea and stored either in plastic bags or silos. The process improves the digestibility by 20%, reduces the wastage and improves the rumen environment. It must be viewed as cost- effective.

Fodder seed mini-kit distribution programme

Fodder seed of good quality forages is the main constraint in forage production. At present there in neither the required availability of improved high yielding varieties of fodder seeds at village level nor is there any technical knowledge resulting in widespread use of low-grade seeds by farmers. Therefore the yield of green fodder is very low.
The project would distribute fodder seeds of high yielding variety in the form of mini-kits to the farmers in the project area. In addition, complete technical knowledge about the programme would also be provided. It is hoped that with the implementation of this strategy, it would be possible to increase per hectare yield by at least 10-20%. Under the programme each farmer would be given a mini-kit of high yielding fodder seed.

Nutritional Management

The project would develop feeding systems, which exploit rumen metabolism processes. Generally, the following nutritional principles will be promoted:

a) The increased use of urea-treated straws and whenever and wherever applicable, the use of urea-mollasses- mineral block supplement.
b) The mixing of green leguminous fodder with wheat/paddy straw, thereby raising rumen ammonia levels and thus increasing the microbial pool available to colonize the high cellulose component of the ration.

ANIMAL HEALTH DEVELOPMENT PROGRAMME

At present a small number of animals are covered under the vaccination programme. It is mainly due to inadequate production of quality vaccines at the Institute of Biological Products of the UP Govt., Lucknow on which the state is dependent for its supply of vaccines since Uttaranchal has no vaccine production centre of its own.

Under the project a provision has been made to carry out preventive vaccination against prevalent important infectious diseases using quality vaccines to be purchased from commercial sources. Adequate budget has been provided for first –aid and treatment of animals. To overcome infertility and parasitic disease problems, infertility camps and de-worming would be organized periodically in the project area. It is proposed to provide a livestock health unit to cover about 5- 10 villages.

TRAINING AND EXTENSION

Under the project two sets of training programmes are proposed. A set of training will be organized for the villagers/beneficiaries of the livestock intervention on the livestock management. Under this, training would be given on subjects such as urea treatment of straw to improve nutritive value, hay making and plastic bag ensilage for fodder conservation etc. Women will be the primary target group for these training. The second set of training is proposed to deploy Para-vets in localities not serviced by DAHF's AI centres. The rural youth, including men and women, with intermediate in biology /agriculture or equivalent (as a minimum requirement) would undergo formal training for 4 months in AI, castration, basic animal health care, extension management and fodder production techniques. Facilities of the In- Service Training Institute of DAHF, Pashulok, Rishikesh, Dehradun would be availed for the training. It is also proposed to impart 7 days practical training for profitable upkeep of livestock to 5 farmers (beneficiaries selected on the basis of their aptitude to raise livestock) and 5 Women Extension Workers, who provide the main task force in rearing animals, from every village in the project area. All trainees will be provided with a copy of a Manual on Improved Livestock Practices, written in simple language.

PROMOTION OF PRODUCTION ACTIVITIES BY PROGRESSIVE FARMERS SETTING UP OF MODEL DEMONSTRATION FARMS OF SHEEP, GOATS, ANGORA RABBIT, POULTRY (LAYERS / BROILERS)

Assistance provided under this sub-component would be targeted at weaker segments of the rural population to improve their employment and income earning opportunities through the following livestock production activities, Goat, Sheep, Angora rabbit and Poultry rearing. The project would provide assistance to organize training, extend technical and management guidance to farmers interested in raising livestock. The training would be imparted improved livestock management practices pertaining to breeding, feeding and disease control for a period of 7 days at the In–Service Training Institute of DAHF at Pashulok, Rishikesh.

As a first step in this direction, it is proposed to set up model demonstration farms of sheep, goat, angora rabbit and poultry.

7. Market

Lack of an organized marketing structure and complexity of policy and regulatory regimes have resulted into unequal distribution of usufruct to villagers/locals leading to degradation of natural resources and loss of biodiversity. The collection /cultivation of NWFP and timber is governed by forest protection acts, transit permits, royalty demands and absence of an organized marketing structure. This makes the trade in NWFP exploitation for the ecosystem people. Moreover, poverty, debt trap and increasing national and international demands have led to the existence of an informal (parallel) marketing channel, which is illegal. Illiteracy, social structure and meager knowledge of regulatory legislation further force the villagers to sell their produce to middlemen at a very lower price. Moreover lack of basic processing and grading skills, which can lead to value addition and consequent higher income is another barrier under base line scenario.

The GEF scenario will aim to remove these barriers by carrying out study of various marketing models in place and bring into place the most suitable model with proper adjustment/modification (co-operative movement has been shown to be successful in milk, sugar cane and marketing of edible oils). The GEF interventions will also include educating the member of village institutions on the aspects of various environment regulations governing the trade of timber and non-timber products. It is also proposed that simple technology and training will be imparted through tie up with appropriate institutions and small scales industries for development of simple, energy efficient tools and other out fits which can be maintained through locally available resources and skills. This will facilitate grading and basic processing of timber and non-timber produce grown different models in the civil and soyam forests. The budgetary requirement will be fulfilled by linking with department of small scales industry, which provides interest free loans and grants to facilitate employment generation and poverty alleviation in similar ventures.